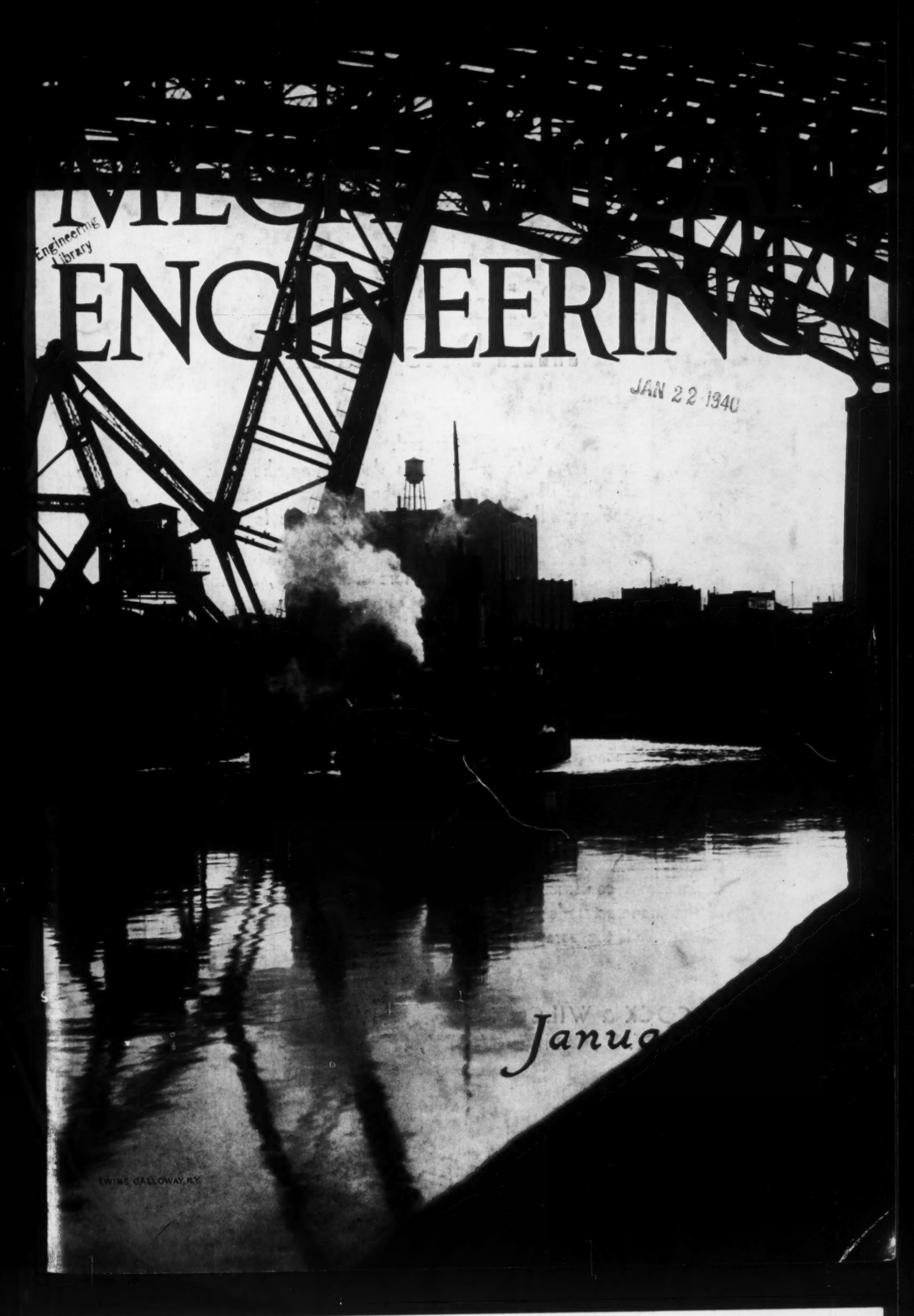
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Boiler Research ...In Perspective

In its earlier stages, boiler research was largely, if not solely, of a simple, elementary character—such as determining the flow of steam through each tube of a superheater tube-bank connected to common headers. B&W proudly referred to 80,000 readings logged in such a test.

A little later, research became more complicated, as more intricate technicalities became involved in the studies made. Typical of this stage were the investigations of stress lines in pressure vessels—studies made with photo-elastic models and polarized light.

Lately, the industry has entered a third stage. In this stage, research has gone beyond the scope of the laboratory and its most intricate of scientific devices, and has moved into the field. The very size of power-plant equipment prohibits laboratory analysis of all that takes place in a modern central-station boiler-unit.

Under these conditions, and with the new designs, new constructions, and new performance-levels that are being demanded today, the purchaser can profit by a dual evaluation. He will, of course, evaluate designs and constructions. But, he will profit far more from an appraisal of the manufacturer's experience or ability to make such designs practicable. This is the paramount consideration. It determines operating results.

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MECHANICAL ENGINEERING

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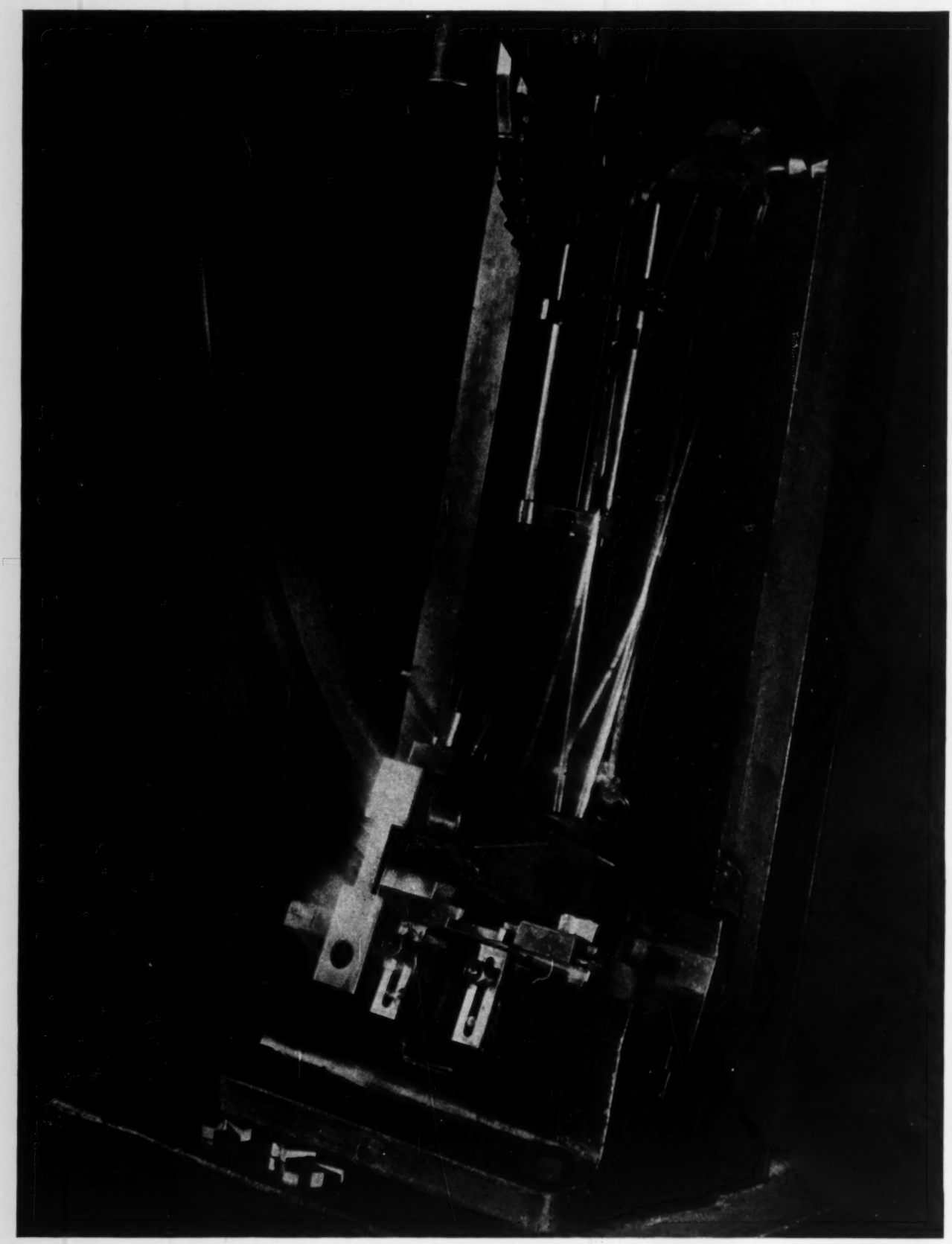

"Swinging Pendulum"

(Photograph taken by Ralph Ernst and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Annual Meeting in Philadelphia.)

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No. 1

MECHANICAL ENGINEERING

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1940

GEORGE A. STETSON, *Editor*

Unionization

COMMENTS on "Unionization of Engineers," by James H. Herron, that appeared in the November, 1939, issue, will be found in the correspondence pages of this issue. This is the first group of comments to be published. Enough material is available, and new letters are received almost daily, to fill the correspondence pages for several issues, and with the publication of these comments more readers will probably wish to present views on the subject under discussion.

When it was realized that Mr. Herron's article would provoke much discussion (some of it was invited by the Committee on Economic Status as a few of the letters disclose), methods of dealing with it were studied and the decision was reached to print all of it exactly as it was received (subject to revisions made by the writers on galley proofs) and as nearly as possible in the order in which the comments were received. Suggestions that the comments be summarized, that they be printed in a separate pamphlet and not in this Journal, and that they be arranged according to some classification of the opinions expressed were rejected. The result is an assurance to discussers and readers alike that the comments are genuine and have been fairly dealt with. By this method a cross section of opinion is made available to readers in the language of those presenting it and without attempts at interpretation.

In spite of honest endeavor to afford readers a free forum, the question has been raised that disclosure of the names of the correspondents may deter some readers from expressing their views for fear of reprisals by employers. The chairman of the Committee on Economic Status and the editor do not have these fears but they are willing, nevertheless, to publish unsigned or anonymous letters provided the writers disclose their identity as evidence of good faith. Hence the wishes of writers not to have their names published, if there are any, will be respected without prejudice to the publication of the views expressed. This offer is made on condition that writers will not abuse the privilege of anonymity and does not, of course, extend to libelous or other statements that no magazine can publish.

It will be evident to anyone who takes the trouble to read the letters published in this and later issues that the desire of the Committee on Economic Status to afford opportunity for full and free discussion of the unionization of engineers is bearing fruit. Variety in points of view must soon become impossible, and in the interests of economy of space and reader patience, writers are urged to concentrate on aspects of the subject not yet treated. At this time the intention is not to vote "yes" or "no" on a question and come to a decision on the basis of a numerical count. Important questions cannot be intelligently decided on such a basis until all sides have been heard from. The value of the present phase of the Committee's work lies in the completeness with which all sides of the questions are brought forth for thoughtful study. It is the task of the Committee to plan its future activities when all the evidence is in. In the meantime, readers to whom the question of unionization is important and perplexing have an opportunity to view it from all sides. This procedure, it will be admitted, is part of the engineering approach to a problem.

Aiding the Human Machine

LAST May the submarine *Squalus* sank in 240 ft of water 16 miles off Portsmouth, N. H. The story of the rescue of the members of her crew who were still alive when help reached them and of the salvage of the undersea craft will become one of the great epics of the sea and engineering. Not since the raising of the *S*-51 from a depth of 132 ft off Block Island, told with such dramatic effect by Commander Edward Ellsberg in his book "On the Bottom," has the public interest been so keenly aroused over the exploits of salvage crews. But since Ellsberg's brilliant achievements in bringing the *S*-51 to the surface and towing it to the Brooklyn Navy Yard with the aid of pontoons, much advance has been made in the technique of underwater salvage work, and in the raising of the *Squalus* these developments were put into practice.

Without the deep-sea diver such work as was done in raising the *Squalus* cannot be attempted. It is hazardous, to say the least. Men work under difficulties and in an environment unusual to an extreme. But science and engineering have made progress here as in other areas of men's work. Writing on some medical aspects of the rescue and salvage operations of the *Squalus* in the October, 1939, issue of the *U. S. Naval Medical Bulletin*, available also in the *Army and Navy Register* for November 25, 1939, Lieutenants A. R. Behnke and T. L. Willmon, M.C., U. S. N., state that "from May 24 to August 1, 372 dives were made without the occurrence of a single case of bends," and further that "several accidents in which divers losing consciousness on the bottom and blown to the surface were treated effectively by compression and oxygen therapy." Surely, this is a remarkable performance.

In the February, 1939, issue of MECHANICAL ENGI-

NEERING, a brief article by Yandell Henderson dealt with the use of helium in deep-sea diving, and it is interesting to note in the medical report just referred to that helium-oxygen mixtures were resorted to when the standard method of using air failed. Testimony of a diver on the effectiveness of substituting helium for nitrogen is quoted as typical: "This dive (on helium) was the best dive I have ever experienced. I did not feel deeper than 50 feet at any time; my head was clear and my mental faculties were working well at all times."

Engineering innovations mentioned in the report as contributing to the success of diving operations were the fireproof, electrically heated garments for cold-water diving, improved recirculation of gas through the diver's helmet, and the perfection of telephone communication, all developed since the *S*-51 disaster.

At the other extreme—an environment of low rather than high pressure—are the conditions met with in high-altitude airplane flights and in operations carried on in mountainous regions, to which Dr. Ross A. McFarland directed the attention of The American Society of Mechanical Engineers at a session sponsored by the Management Division in connection with the 1939 Annual Meeting of the Society. Here again evidence was adduced to show that an intelligent application of research to problems affecting engineering developments is extending simultaneously the fields of medical science and engineering. Dr. McFarland's larger subject was the effect of external environment on fatigue and included other environmental factors, such as high temperature, as well as high altitude. But in his lecture, as well as in the report on the *Squalus* rescue and salvage, it becomes increasingly evident that the introduction of the biological reference into the definition of engineering, made by Karl T. Compton and recently quoted in these pages, is entirely appropriate.

Two objectives of Dr. McFarland's studies, the search for a physiological pattern by means of which workers likely to be adapted to conditions of extraordinary external environment and the throwing of some scientific light on the vexing problem of the aging worker, will appeal to all engineers as being extremely practical and valuable. Further developments will be awaited with intense interest.

In the case of the *Squalus* rescue and salvage the benefits of science to engineering are dramatically demonstrated. In the case of Dr. McFarland's researches they are none the less important. To operate certain machines of his own contriving man must know more about his own human machine. These particular interdependencies of science and engineering illustrate one of the sure methods by which man makes progress and afford striking contrasts to the misuse to which both engineering and science are being put in wars between nations.

Story of a Paper

IN THE aftermath of the most devastating hurricane that has visited New England in a century, about 50 members of The American Society of Mechanical Engineers attended a session of the 1938 Fall Meeting of the Society to listen to Gregory J. Comstock deliver a paper on powder metallurgy. If Mr. Comstock was disappointed at the size of his audience, he said nothing about it, but proceeded to the presentation of his subject with as much enthusiasm as though he were addressing the entire Society. It was an excellent presentation, but if this had been all, one might question the effectiveness of a procedure that had cost Mr. Comstock and the Society so much in time and money for the benefit of so small an audience. But it was not all—it was only the beginning of a series of events that is still in progress.

Mr. Comstock's paper was published in this magazine. Upward of 20,000 copies went to members of the Society, to students in more than 100 engineering schools, and to at least 1500 libraries and nonmember subscribers. How many other magazines "picked up" the story in full or in abstract it would be hard to discover, but it is known that several thousand copies of the paper were reprinted on several occasions over the period of the year that followed and presumably these were widely distributed for a variety of purposes. Literally thousands of persons read about powder metallurgy.

Nor was this the end. Present at the session at Providence among the handful of engineers who listened to Mr. Comstock was the then president of the Society, Harvey N. Davis, who attended to satisfy his curiosity about a subject which seemed to promise so much for engineering and which had so bountifully enriched the field of metallurgy. Dr. Davis asked questions. He went back to Stevens Institute and thought about it. Like many another engineer he asked himself, "How does this fit into my business?" And as Dr. Davis' business is engineering education, the answer was obvious. Powder metallurgy was something student engineers should have brought to their attention. Conferences followed, and to the faculty of Stevens there was added not only Mr. Comstock himself but another expert in this field, Claire Balke, son of Professor Clarence Balke who has devoted many years of his life to teaching, research, and metallurgical practice in this field.

The present phase of this series of events, commenced by the presentation of a paper before a small group of engineers, will be formally initiated in February, 1940, when Messrs. Comstock and Balke meet the first classes in powder metallurgy to be offered at Stevens, and when the new powder-metallurgy laboratory established there will begin its research and instructional activities.

Stevens will not be the first institution to pay attention to this branch of engineering science, but the chain of events by which the course was set up at that institution is worthy of notice, because it demonstrates what collateral and unpredicted benefits flow out of engineering meetings.

Hundreds of men pass in and out of the technical sessions (in this case the number seemed pitifully small) and thousands thumb over the pages of engineering journals. How many alert minds ask the question: What does this mean to me? and find a useful answer is never fully known, but the adoption of new techniques, materials, machines, and methods is evidence of the value of engineering societies as forums.

POSTGRADUATE TRAINING *of* YOUNG MECHANICAL ENGINEERS

By A. G. CHRISTIE

PRESIDENT, THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

MUCH constructive thought has been devoted to the undergraduate education of engineering students and this has resulted in improved quality of instruction. While study has been given in scattered industries to methods of training young engineering graduates to fit the needs of a particular organization, no unified national policy has been developed. A by-law of this Society states that certain of the objectives of the Society shall be accomplished by "encouraging the personal and professional development of young engineers." Such training becomes a special interest of both the Council and the members. There is need at the present time for bold initiative, masterful invention, and new production methods that will lower costs, if American leadership in manufacture is to be maintained. Industry looks to the enthusiastic young men from technical schools to meet these needs. Hence the postgraduate training of such young engineers is a matter of great national importance and an immediate responsibility of industry.

DESIRED OBJECTIVES IN POSTGRADUATE TRAINING

Every nation has endeavored to become self-sufficient since the Great War. Each country has attempted to train artisans in manufacturing skill and engineers in design, development, and management. Certain countries have the advantage of low labor costs and completely modernized plants. Low production costs enable their products to be sold profitably in world markets and sometimes even in America, in competition with native goods.

America faces a period of keen competition with other countries where necessity has driven men to prodigious efforts in the search for new and substitute materials, lower costs of production, and expanding markets. Habits of industry and hard work have been developed abroad and national programs have been unified. In America much has been lost in morale, unity, and technical skill as a result of the depression while at the same time there exists a false feeling of superiority to other nations. At present more thought is given to short working hours, high wages, and social security than to the industrial developments that will assure these ends. The war abroad makes it imperative that American industry, and particularly our engineers, be prepared in the best possible manner for emergencies that may arise.

American industry, in order to survive and prosper in international trade, must develop an objective training program for young mechanical engineers. The definite objectives of such training should be (*a*) self-confidence of our engineers based upon thorough technical instruction, (*b*) their aggressive initiative through encouragement by industry both in original invention and design and in the introduction of new production methods, and (*c*) adequate financial remuneration during training periods with ample rewards for accomplishments in invention and production. Obviously, the development of the best human engineering material is a sound investment for every American industry.

Presidential Address delivered at the Annual Meeting, Philadelphia, Pa., Dec. 4–8, 1939, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

PREVIOUS DISCUSSION OF POSTGRADUATE TRAINING

Postgraduate training has received much thought in the past and many papers present discussions of the various systems that have been tried in industry. The Engineers' Council for Professional Development (E.C.P.D.) has a Committee on Professional Development which has done constructive work and has published several reports.

POSTGRADUATE STUDY IN COLLEGES

Only a few years ago, a doctor of engineering was looked upon by executives as an overtrained theorist. Today such men are quickly engaged by industry and are in demand. Industrial managers have learned that these doctors may solve their increasingly intricate problems of engineering, can initiate and direct research in their laboratories, and can develop new productive plans in shops. In view of this demand for men with graduate training, several questions arise: What men should be selected for such instruction? What should be the nature of this training? And where should it be given?

All men do not possess equal engineering aptitudes. The problem is to select for graduate work only those men who have shown in their undergraduate training that they have certain abilities, and, further, to prevent graduate schools from encumbrance with men lacking the desired aptitudes regardless of whether fond parents can afford to pay for additional years in college. The desirable abilities in a candidate include high attainments as an undergraduate in mathematics, physics, chemistry, and mechanics, and a capacity to carry out original analyses rather than simply to follow instructions or to use handbook formulas. He should also possess a personality which suggests leadership and ability to influence others in later life. It is difficult to recognize these qualifications when a stranger applies for admission to graduate work. For this reason, the two years' course for a master's degree has advantages, for the poorly qualified men need not be accepted for the second year. Courage, firmness, and tact are required of the staffs of graduate schools to enforce such selection of students. However, this is absolutely necessary if the best results for the nation as a whole are to be expected from these graduate schools.

These selective methods may seem harsh and discriminatory. They are based upon the experience of many years in, and observation of, graduate instruction both here and abroad. They conform with the selective methods of our best medical schools, which require not only a bachelor's degree for admission, but a rigid appraisal of the applicant's possibilities as a medical practitioner. The wisdom of the application of such ruthless methods of elimination to candidates to medical schools is not questioned. Industry should demand that doctors of engineering be as carefully selected and as thoroughly trained as are doctors of medicine.

Few should be chosen for postgraduate work, for this training

is expensive. The instructional staff of graduate schools should consist of the most competent and experienced men available. These must be highly paid to retain their services. Best results are obtained with few students in intimate contact with their instructors. Much effective graduate instruction is provided when instructor and students sit around an office table and discuss problems. Formal methods of undergraduate instruction must be replaced by supervised self-education. A doctor of engineering should be one who is master of his special subject. This mastery implies a thorough grasp of mathematics and the sciences and their general application in engineering, together with a high degree of specialization in the one particular branch to which he has devoted most study. This knowledge of fundamentals will enable him readily to familiarize himself with problems in other branches of engineering. During his training he must do original research which usually requires expensive laboratory equipment and which produces results that form a new contribution to knowledge. Tuition fees never cover the cost of graduate instruction. Universities therefore cannot afford to accept any but the most promising graduate students. Graduate schools should be endowed or given adequate financial support properly to carry out their functions. Industry can no longer allow such institutions to be literally starved for money.

Graduate training should extend over sufficient time to give a man that independence of thought and action which enables him, without the guidance of others, to develop his own problem and to proceed to its solution. This competence develops slowly in the average man. It is questionable whether this competence can be gained in the single year of study now generally required for a master's degree.

Such instruction can only be given at institutions with excellent graduate staffs in mathematics and the sciences as well as in engineering, together with ample laboratory equipment and funds for experimental work. The author urged in a former paper[1] that graduate instruction in engineering be confined to a few colleges which could be properly financed and have the best staff available. This recommendation still holds.

A man should preferably take his graduate work at an institution other than his undergraduate school. He receives new points of view from instructors, finds different laboratory methods and equipment, and widens his acquaintance by meeting other associates. All these things must broaden his experience and outlook.

Men with proper qualifications for graduate training are often unable to finance such work. Since men of this type are essential for the continued technical development of this country, it is incumbent upon both state and industry to establish such scholarships as will enable these men to complete their graduate studies without financial worries. Few scholarships are now available, yet they are more important than the undergraduate scholarships so liberally provided.

Many writers have presented discussions of the social and political responsibilities of engineers and of the need of inculcating young engineers with a sense of these obligations. Such aspects of postgraduate study will not be considered here further than to point out that these discussions have, for the most part, been couched in general terms without specific outlines of needed courses of instruction.

TRAINING BY INDUSTRY

The methods and results of graduate training by industries are more difficult to appraise than college work. Some industries provide comprehensive training programs, others give only local instruction for particular jobs which approach the apprentice type. A graduate of an engineering school is in much the same status as the graduate of a medical school. Before entering active practice the young medical doctor serves his "internship" in a hospital. Similarly, the engineer should serve his in the works. But there is some doubt whether the average training course gives a graduate in engineering as much opportunity to observe and learn technical process as a medical student secures in attending and sharing in hospital clinics and duties.

Industry is expected to find a place for the man with a bachelor degree as well as for the man with advanced training and to train each man to be of the greatest benefit to himself and to the organization. A man fresh from college usually has had little industrial experience. Certain general aptitudes may be found by psychological or other tests. These men generally have to be tried at different tasks before the man or his supervisor can determine the branch of the industry for which he is fitted and where he may complete his training.

This preliminary training may take several forms. The man may be put on a regular job and slowly advanced as opportunity and ability warrant, with some guidance from his superiors. He may be placed on a so-called "college apprentice" course where he works on one production task after another until he is familiar with the entire plant. A third method is the survey or "loop" course where he is a member of a party that observes and studies all processes in the plant under the direction of a supervisor. The advantages and disadvantages of each method have been presented in a recent paper.[2] Obviously, a fresh study of this training by industry and a definite plan for future development is now needed. A frequent criticism of the college graduate is that he is impatient and desires promotion to a responsible position before he has gained the necessary experience. Colleges which give their students an exaggerated idea of their value to industry are responsible for this condition.

Mechanical engineering as a profession depends upon experience in the design, application, and use of machines, and the direction of men in industry. The more thorough the graduate's knowledge of every phase of the business and its machinery the more competent will he become in later years. Too often there is a tendency to shorten the time spent in the shops or over a drawing board. This is a mistake that needs correction. Our industries should not have to depend upon foreign sources for designers and draftsmen. Even if some other branch is followed later, experience in design enables an engineer to present his ideas effectively and to appraise the drawings of others. Also, experience with production machinery is an invaluable asset later to an executive of an industry.

Some industries maintain longer training periods than others. Graduates who are attracted by the shorter courses, fail to appreciate the importance to men of "replacement value." A man who has spent a long period in training has as a consequence a higher replacement value to the industry than one whose job could be assumed by a newcomer after brief instruction. Jobs should therefore be measured in terms of "replacement value."

The graduate's pay during his training should be ample to enable him to live comfortably. Even though he may not earn such pay, this expense to industry is part of the price that it must pay for competent staff. Low rates of pay fail to attract the better men who might be of greatest value to industry.

Probably the greatest weakness of graduate training is the frequent failure to recognize the profound changes in the life and habits of thought of the man upon entering industry. He has been subject to intensive mental stimulation during his four or more years in college. He has learned to study rapidly

[1] "A National Policy on Engineering Education," by A. G. Christie, MECHANICAL ENGINEERING, vol. 44, January, 1922, pp. 3–5.

[2] "Orienting the College Graduate in Industry," by E. W. Kempton, *Personnel*, American Management Association, August, 1939.

and effectively and to concentrate his whole attention upon the subject matter. Long hours of work have been a necessity. In general his life in college has been that of a busy man devoting his whole energy toward a definite objective.

The graduate's work during the first portion of his industrial training usually consists of simple shop operations or routine office work. These require small mental effort, and, being of a repetitive nature, offer little to stimulate his interest. The novelty of industry holds his attention at first but soon wears off. The man loses much of his mental alertness and often acquires an indifferent attitude toward industry. This early portion of the training period deserves most careful study by executives if they would retain the keenness of thought and the ability to accomplish results that the man displayed in college.

The employer should make better use of undergraduate work habits and singleness of purpose. The training system may be modified so that the various tasks involve more responsibility, and, where possible, these should take the form of problems to be solved. For instance, one company assigns a man to tasks which force him to use his brain and to display initiative.

EDUCATIONAL ASPECTS OF TRAINING

The present curricula of engineering schools devote much time to fundamentals as embodied in mathematics and the sciences and to cultural subjects. There are fewer specialized courses than was the case thirty years ago when many of the older engineers now in charge of industry received their training. Many executives do not appreciate the obligation placed upon industry to supply to the incoming graduate the specialized training that is needed in their particular business. Methods and processes in the industry which have not been covered by college courses can be presented in lectures and problems. A more important consideration is the rapid technical advance in many industries, which advances are not covered by average college courses and actually embody principles usually considered in graduate instruction. It is industry's direct obligation to provide such training to its employees. Finally, graduates frequently secure employment or are assigned to work in other branches of engineering than the one followed in their undergraduate work. They should be given an opportunity to take courses of study covering this new work.

Industry now has the problem and responsibility of providing its specialized training, advanced instruction beyond undergraduate courses, and opportunities for study in related subjects if our young men are to be permitted to develop to their full capabilities. This is a large responsibility which, however, must be assumed if America is to continue its industrial leadership. How can it be discharged? The graduate should be given much of this instruction as soon as he enters industry and before he loses his study habits. This will avoid the letdown period that usually occurs after he enters the works.

Many urban universities offer evening undergraduate courses to which the industry can send its men and a few schools offer evening graduate courses. The British Provincial Technical Schools have developed night courses in close cooperation with local industries and the results have been very encouraging. The time is approaching when all urban universities will have to provide full programs of such evening courses. An alternative which is particularly applicable to graduate training is the provision by the university of part-time instruction on certain days of the week for men in industry. These men could be sent by industry on the company's time and expense. The opportunity for these employees to secure advanced degrees by this means leads to the development of earnest, ambitious young men in the organization. Undoubtedly, graduate instruction to men in industry can be provided in the best manner and at the lowest cost in engineering schools when these facilities are available.

When such university training is not available within motoring distance, the industry should supply competent instructors who would conduct classes. Senior engineers may undertake this class instruction themselves if competent, or it may take the form of individual instruction. Older men are sometimes reluctant to give such training since this may lead to their replacement by the younger men. But such teaching keeps the older man abreast of his subject and often induces further study and development on his part. With his wider experience he should always be of greater value to his employer than the student.

The final resort of the ambitious young engineer is home study. Difficult, often discouraging, and time-consuming as this may be, its effectiveness is unquestionable. What one learns by such hard work is not quickly forgotten. Much time and effort may be saved through help, guidance, and encouragement by the senior engineers who should consider this assistance to the younger men as one of their obligations, as emphasized by Prof. J. K. Finch in a recent article.[3] E.C.P.D. has issued pamplets on "Suggestions to Junior Engineers," "University Extension Facilities," and "Selected Bibliography of Engineering Subjects," which suggest splendid programs for both cultural and technical self-education.

During recent years there has been an overemphasis of sales engineering as a means of accelerating business recovery. While this field has a useful and necessary place in industry and will be further developed in the future, new and better products and goods produced at lower costs as the result of engineering development are more urgently needed. Emphasis should therefore be placed upon the training of men for the design, development, and research necessary to produce these results.

Another praiseworthy development has been the educational movement in local sections of our national engineering societies and particularly among the junior members. Groups have been organized into classes for advanced instruction and for other educational efforts. E.C.P.D. has issued an excellent pamphlet on "Suggested Operating Program for the Professional Development of Junior Engineers." Every young engineer should join his national engineering society upon graduation and these activities form an additional inducement to do so. These movements deserve hearty support from industry and from the older members of the several societies.

In Great Britain the examinations for admission to membership in the engineering societies act as an incentive to advanced study and a review of fundamentals by the practicing engineer. In this country the examinations for state licenses as professional engineers will make similar demands upon college graduates when the requirements for such licenses include a broad knowledge of engineering principles and their application.

Training programs in industry may occasionally uncover good men who have developed since leaving college. These men should receive every aid and encouragement from industry to develop themselves further by advanced study.

INDUSTRY'S INTEREST IN ENGINEERING EDUCATION

Industry should employ every means to develop the creativeness of the young graduates. Their early suggestions may be impractical. Instead of being ridiculed for making these proposals, they should be courteously shown what is wrong with their plans and encouraged to try again. Too many a sensitive youngster has had his first ideas so roughly treated that he has abandoned all thought of trying to make improvements.

Attention has already been directed to the possibilities for

[3] "Practicing Engineers as Educators," by J. K. Finch, *Civil Engineering*, June, 1939, pp. 331–332.

joint action by industry and the colleges in graduate training. Industry has some further interests in engineering education.

T. M. Girdler has pointed out[4] that industrial laboratories are in general devoted to research upon problems of immediate practical application. Yet all research in the last analysis depends upon the vast accumulation of scientific knowledge derived from the researches of scholars. Many of these scientific discoveries seem of little practical value at the moment. Yet whole industries are founded upon their later applications. This source of knowledge must be kept intact. Industry should therefore provide substantial support to such graduate research for the continued supply of basic facts.

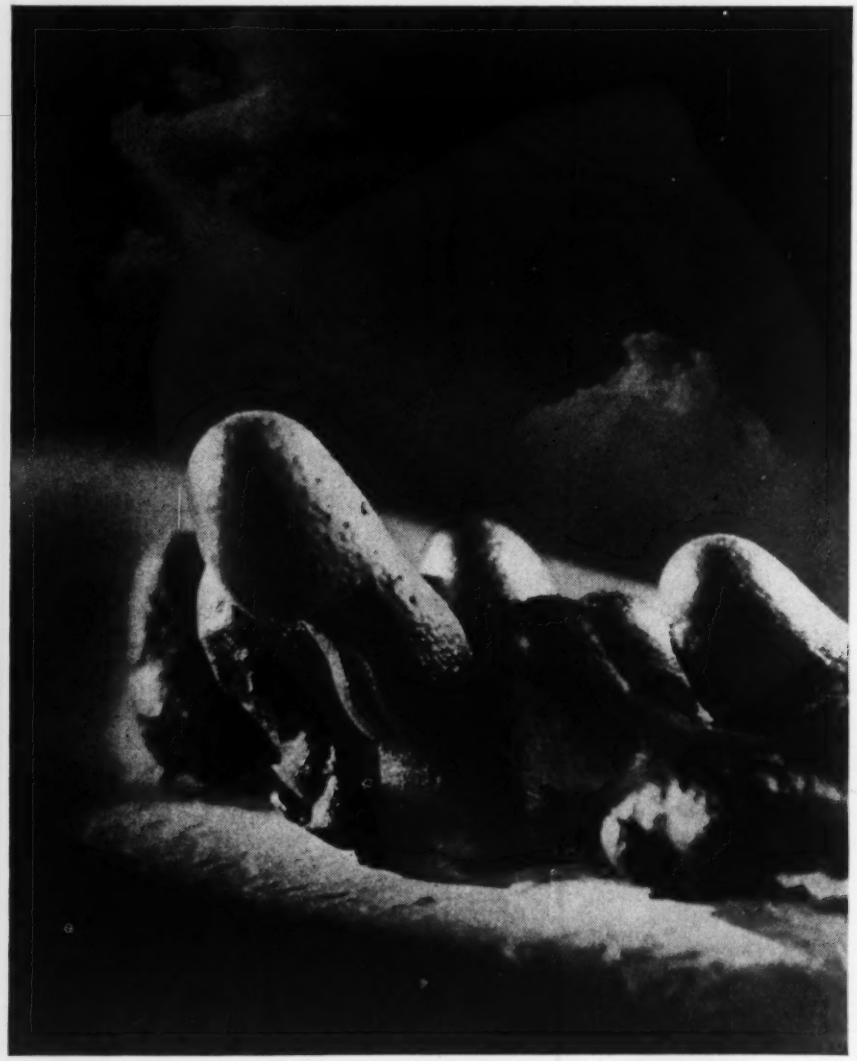
The state controls engineering education in many other countries and similar control is proposed here. The privately endowed institutions which are free from such control are suffering from lack of funds. Unless some relief is given soon these will have to seek public support. The best interests of industry will be served by maintaining these private institutions free to seek the truth in any way that they desire and free from political domination.

[4] "Industry's Obligation to Science," by T. M. Girdler, Case School of Applied Science, 1939.

CONCLUSION

Colleges merely prepare men to enter training in the practice of engineering. The preceding discussion shows that the graduate schools should devote their attention to the development of the exceptional man. Specialized training in engineering subjects beyond that of the four-year course is needed by college graduates taking jobs under present-day conditions. The responsibility for such training rests squarely with industry. While several plans for such training already exist, the problem in general has not been satisfactorily solved and much remains to be done. Some accrediting agency such as the Engineers' Council for Professional Development should be assigned the job of developing a comprehensive plan for such training and for checking the results of its application.

America looks to her young engineers for future developments. They must have the best training possible. The colleges are doing a creditable job. It is industry's responsibility to complete the postgraduate training of our young mechanical engineers in a better manner than heretofore.



"MELANCHOLIC SLAG"

(Photograph taken by W. T. Reid and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Annual Meeting in Philadelphia.)

THE NEW SPECIFIC HEATS

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ONE of the feats of twentieth-century physics, effectuated in the first half of the present, fourth decade, is the development and use of a radically different method of determining the thermal properties of gases. The purpose of this paper, after an outline description of methods and a showing of curves, is to present the results of that research in the form of numerical tables.

THE RESEARCH BACKGROUND

The older determinations of the specific heats of gases were essentially if not wholly empirical, through direct and indirect experiments. The older direct measurement was by water calorimetry, absorbing the heat given up by a body of gas in cooling. This method of heat measurement persists in the two forms of fuel calorimeter. Later came the method, largely used also on superheated steam, of measuring electrical energy on its way to conversion into heat for raising the temperature of a gas current. When temperature ranges and differences are large in such experiments, the problem of insulation of the process becomes increasingly difficult; or the error, because of heat leak, is likely to be large. Further, with a gas, as against a condensable vapor, the accurate measurement of substance quantity is rather difficult.

With least departure from simple thermal ideas, the explosion method is indirect in that it infers temperature rise from pressure rise. Necessarily used for flame temperatures, and the only older method available for high ranges, it is subject to large errors or uncertainties.

A really indirect method is that of finding ratio $\gamma = c_p/c_v$. With the gas constant R known in the gas equation $pv = JRT$ and with $c_p - c_v = R$, it is then easy to derive the specific heats. The form of experiment, in which a gas expansion is made so rapid as to be essentially adiabatic, depends upon a difficult measurement of transient pressure. The scheme of determining the velocity of sound, from which ratio γ is inferable, is distinctive in that it operates in a constant state of the substance, instead of depending upon a change of state. Either kind of experiment is limited to moderate ranges of temperature.

On the side of kinetic gas theory, the older molecular analysis has run parallel with the development of empirical knowledge. For the one-atom gas (having one atom to the molecule) that theory was able to fix the values (constant) of the specific heats. With molecules of two or more atoms, the older theory did not get far. As may be seen in Fig. 1, it reasoned out values that are fairly approximate at moderate temperatures; but, for the rise of specific heat with temperature, there was no more than a suggestion of possible atomic energies within the molecule.

This brief review of older knowledge leads up to the newer combination of complete and elaborate theory with accurate but indirect experiments. From the relatively simple analysis and integration of whole-molecule motion and energy, advance has been made to analysis of atom motions within the molecule and associated energy states or energy contents—even going so far as to evaluate the influence of atom grouping or molecule structure. Then this rational quantitative theory is made definite by means of spectroscopic observations which determine the relative numbers of molecules that are at particular energy levels.

The present viewpoint is that the results of this research by competent physical chemists are to be accepted and are to be used as engineering data, without need of a full or even an elementary understanding of theory and experimental technique.

AN EXHIBIT OF CURVES

The curves in Fig. 1, on a base of deg C absolute or deg

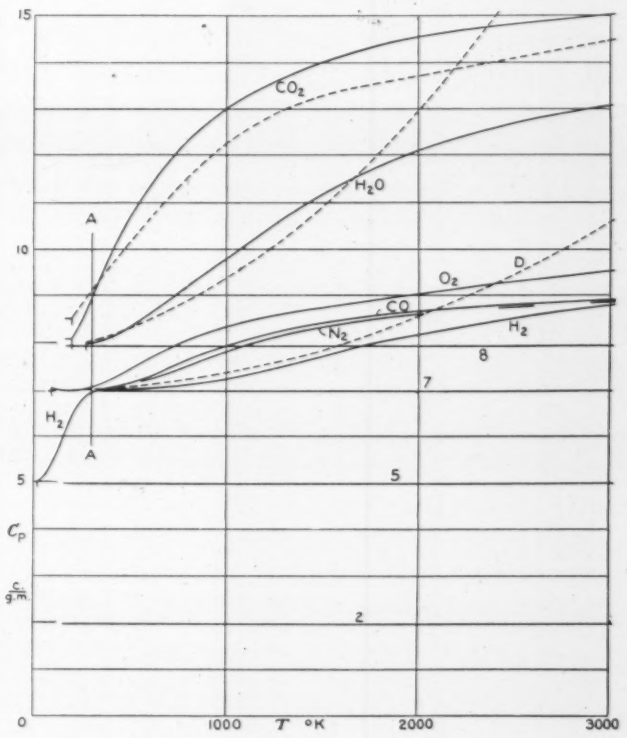

FIG. 1 CURVES OF C_p FOR SIX GASES

Kelvin, show constant-pressure heat capacity C_p per mol, the mol (mole) being the quantity measured by a number of weight units equal to the molecular weight. Heat capacity in consistent units is like the pure ratio "specific heat," in being a dimensionless number. Then, while the ordinate scale is labeled c/gm or cal per g-mol, it might equally well be Btu per lb mol.

Curves are drawn for the six gases that enter into high-temperature combustion calculations, this range being in contrast with the one for precombustion mixtures after engine compression. The full-line curves show the new determinations and are plots of the C_p columns in wider-range tables than those presented herewith. Each curve starts from the vaporizing temperature of its liquid under atmospheric temperature, which is a sublimation temperature for CO_2; and the curve portions below 300 K are from the data represented by Fig. 2. The dotted curves show Goodenough's formulas, as given for instance in Marks's Handbook of 1930, with the curve marked *D* for the whole group of two-atom or diatomic gases. Curves for

constant volume C_v would lie below the ones here drawn, each at the constant distance

$$R = C_p - C_v = 1.985 \quad [1]$$

The conclusions of the older kinetic theory are represented by the horizontal lines numbered 2, 5, 7, and 8 in Fig. 1. The numbers stand for halves of constant R or 1.985 and the quantities shown are as follows:

From the base to line 2, constant R itself, with the effect of representing work rate in constant-pressure expansion; then from the base line up to any other line or curve appears C_p, from line 2 upward appears C_v.

From line 2 to line 3, factor 1.5 R, which is the rate of increase per degree of the total kinetic energy of translatory motion of the molecules in the mol of gas; line 5 shows the ideal or minimum specific heat C_p of the monatomic gas, of which argon and helium are the prominent examples; and, for such a gas, real C_p will rise from line 5 by only a very small amount at high temperatures.

For the two-atom gases, with two added "degrees of freedom," the ideal specific heat rises to line 7 or 3.5 R and, for the three-atom gas, it rises to line 8 or 4 R.

Except for the peculiar behavior of hydrogen, in first rising from 5 to 7 below the ice point, the two-atom gases conform well to line 7 through a moderate range; and the three-atom gases at least start from about line 8. As to the curves of actual rising C_p, these are given for information, not for speculation as to why they show certain trends and differences. Note that the N_2 and CO curves are not carried down to their liquefaction points; this is done in order to avoid confusion in a small drawing.

Present quantitative interest begins at line AA in Fig. 1, or at 300 K; but there is a general interest in seeing what is known in the range from that temperature down to absolute zero. This matter will be considered briefly, before taking up the tables of gas heats.

LOW-RANGE BEHAVIOR

In Fig. 2, the quantity exhibited is not specific heat but heat

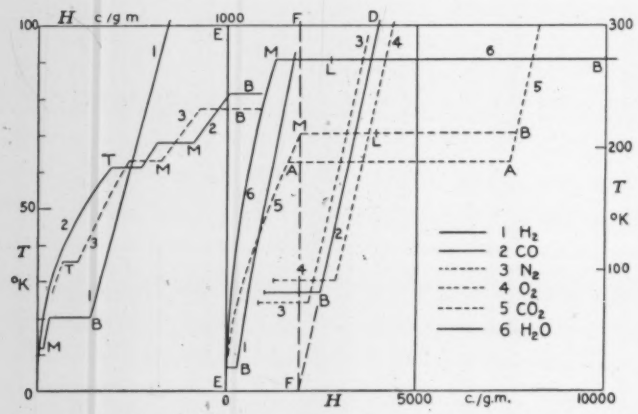

FIG. 2 HEAT CONTENT OR ENTHALPY H FOR SIX GASES

content or enthalpy H, still in cal per g-mol. The drawing is in two parts, both on a vertical scale of temperature T with ordinate H horizontal. A magnified section, to the scales at left and top, shows three of the gases in their range of solid and liquid phases. Then, with change of vertical origin line to EE and with the scales at right and bottom, the larger section makes a complete showing of vaporization and gas heating, at and from normal boiling point (under atmospheric pressure) up to 300 K. The letter notation, in physical order, is as follows:

T = Transition in the solid phase, from one crystalline form to another and with heat absorption in the two cases shown.

M = Melting or fusion, followed by heating of the liquid to:

B = Boiling point, under atmospheric pressure except in case of CO_2 and H_2O.

A and L will be defined in their special connections.

For the solidified gases, as for all solids, specific heat C drops to zero at the absolute zero of temperature; and this fact makes it possible for any substance to have a definite total or absolute entropy. As seen in the complete curve for gas 2 or CO, the curve of solid heating starts in tangency to the temperature axis.

All of the gases show small heats of fusion and, in the case of CO, the heat of transition is almost as large as the heat of fusion. The heat of vaporization of hydrogen is very small, while that of water runs off the range of the diagram.

Since CO_2 has a vapor pressure of about 5 atm at its melting point of 216.5 K, it normally sublimes at 194.6 K, where the vapor pressure is 1 atm, or at the height of line AA. Along line MLB melting is completed at point L, to be followed by vaporization from L to B; further, this isothermal length includes at end B the increment of H from higher to lower pressure, down the gas isotherm.

For H_2O point L similarly sets off heat of fusion ML from heat of vaporization at the ice point; the latter running beyond the right-hand edge of the diagram. It is of interest to note that at ice point L (of the liquid phase), which is the zero point of the steam table, the absolute enthalpy H_0 is 2712 c/gm or 271 Btu per lb. Further, heat H for gaseous H_2O is supposed to be the zero-pressure value that is basal to the superheat steam table; and the H_2O curve in Fig. 1 shows the specific heat C_{p0} that is used in the latest (Keenan and Keyes) steam tables.

Having chosen a working origin of energy and enthalpy at 300 K, it is of interest to know definitely (and with fair accuracy) how far absolute values extend below that state. This downward extension can be taken in two ways, as indicated on the particular gas CO or gas 2 in Fig. 2. From D to E on the top line may be seen real H_0; while from D to F is seen the effect of carrying "hypothetical gas behavior" down to absolute zero, along a path not much different from a straight-line extension of line DB. The numerical values of DE and DF are as follows:

	H_2	CO	N_2	O_2	CO_2	H_2O
	c/gm					
Absolute H_0	1953	4006	3757	4360	8350	13590
Gaseous H_0	2049	2085	2086	2084	2256	2376

Most of the data for line 1 in the table are from International Critical Tables, with some supplementation by later publication; integration and summation are by the author. Line 2 is from the chemists' tables.

THE GAS TABLES

Tables 1, 2, and 3 given herewith are on a base of deg F absolute or deg Rankine, with a range from 540 to 5400 R, primarily 300 to 3000 K. It is enough to give the 1-mol specific heat C_p, since C_v is uniformly smaller by 1.985. The heat numbers H and U are in Btu per lb mol. In the present connection, "heat content" is an adequate name for $H = \int C_p dT$, from $T_0 = 540$ as the lower limit. There is here no real need for the broader meaning conveyed by the name "enthalpy." Internal energy U comes from H as

$$U = H - 1.985(T - 540) \quad [2]$$

These tables are interpolated and converted from more extensive tables on centigrade degrees, which include the entropies associated with H and U and are carried to 5000 K. Those

TABLE 1 NITROGEN AND OXYGEN

N_2 $M = 28.016$				O_2 $M = 32.00$			
T	C_p	H	U	C_p	H	U	T
600	6.968	418	299	7.075	423	304	600
700	6.986	1116	798	7.174	1136	819	700
800	7.019	1816	1300	7.297	1860	1344	800
900	7.071	2520	1806	7.434	2596	1881	900
1000	7.140	3231	2318	7.570	3345	2432	1000
1100	7.216	3950	2838	7.700	4109	2997	1100
1200	7.300	4676	3366	7.822	4885	3575	1200
1300	7.389	5411	3903	7.931	5672	4164	1300
1400	7.482	6154	4447	8.030	6471	4764	1400
1500	7.571	6905	5000	8.119	7279	5373	1500
1600	7.657	7665	5562	8.201	8095	5991	1600
1700	7.740	8435	6133	8.275	8918	6616	1700
1800	7.821	9214	6713	8.341	9749	7248	1800
1900	7.899	10001	7301	8.399	10587	7887	1900
2000	7.971	10795	7897	8.452	11431	8533	2000
2100	8.036	11596	8499	8.501	12279	9183	2100
2200	8.094	12402	9107	8.548	13131	9836	2200
2300	8.148	13214	9720	8.591	13987	10494	2300
2400	8.199	14031	10338	8.631	14848	11156	2400
2500	8.247	14853	10962	8.669	15712	11822	2500
2600	8.292	15680	11591	8.705	16580	12491	2600
2700	8.334	16511	12224	8.740	17453	13165	2700
2800	8.373	17346	12860	8.774	18329	13843	2800
2900	8.410	18185	13500	8.807	19208	14524	2900
3000	8.444	19028	14144	8.840	20091	15208	3000
3100	8.475	19874	14792	8.872	20977	15895	3100
3200	8.504	20723	15443	8.903	21866	16586	3200
3300	8.531	21575	16096	8.935	22759	17280	3300
3400	8.557	22430	16753	8.966	23654	17977	3400
3500	8.581	23287	17411	8.998	24552	18677	3500
3600	8.604	24146	18072	9.029	25454	19380	3600
3700	8.625	25007	18735	9.059	26360	20087	3700
3800	8.646	25871	19400	9.089	27268	20797	3800
3900	8.665	26737	20067	9.118	28179	21509	3900
4000	8.684	27605	20736	9.148	29092	22224	4000
4100	8.701	28474	21407	9.177	30008	22942	4100
4200	8.717	29345	22080	9.206	30928	23663	4200
4300	8.733	30218	22754	9.234	31850	24386	4300
4400	8.747	31092	23429	9.262	32774	25112	4400
4500	8.761	31967	24106	9.290	33701	25841	4500
4600	8.774	32843	24784	9.317	34631	26572	4600
4700	8.786	33721	25464	9.344	35565	27307	4700
4800	8.798	34601	26145	9.371	36501	28045	4800
4900	8.809	35482	26827	9.397	37440	28786	4900
5000	8.820	36364	27510	9.423	38382	29529	5000
5100	8.831	37246	28194	9.449	39325	30274	5100
5200	8.841	38129	28879	9.474	40270	31021	5200
5300	8.851	39013	29565	9.498	41218	31770	5300
5400	8.860	39898	30251	9.522	42168	32521	5400

TABLE 2 CARBON MONOXIDE AND HYDROGEN

CO $M = 28.00$				H_2 $M = 2.016$			
T	C_p	H	U	C_p	H	U	T
600	6.971	419	300	6.933	416	297	600
700	7.004	1120	802	6.964	1111	793	700
800	7.055	1822	1306	6.982	1807	1291	800
900	7.122	2528	1813	6.992	2505	1791	900
1000	7.207	3243	2330	7.001	3205	2292	1000
1100	7.298	3969	2857	7.011	3906	2794	1100
1200	7.395	4704	3394	7.025	4608	3298	1200
1300	7.493	5449	3940	7.044	5312	3804	1300
1400	7.590	6203	4496	7.067	6018	4312	1400
1500	7.684	6966	5061	7.096	6727	4822	1500
1600	7.774	7739	5635	7.134	7438	5335	1600
1700	7.857	8520	6217	7.177	8153	5851	1700
1800	7.936	9309	6808	7.222	8873	6372	1800
1900	8.008	10106	7407	7.271	9598	6898	1900
2000	8.076	10910	8012	7.323	10329	7430	2000
2100	8.139	11721	8624	7.376	11065	7968	2100
2200	8.196	12537	9242	7.431	11805	8510	2200
2300	8.248	13360	9866	7.487	12550	9057	2300
2400	8.297	14188	10495	7.543	13300	9608	2400
2500	8.343	15020	11129	7.600	14056	10165	2500
2600	8.384	15856	11767	7.658	14819	10729	2600
2700	8.422	16696	12409	7.716	15588	11300	2700
2800	8.457	17540	13054	7.774	16364	11877	2800
2900	8.489	18388	13703	7.831	17145	12460	2900
3000	8.519	19239	14356	7.887	17931	13048	3000

TABLE 2 CARBON MONOXIDE AND HYDROGEN (Contd)

CO $M = 28.00$				H_2 $M = 2.016$			
T	C_p	H	U	C_p	H	U	T
3100	8.547	20093	15012	7.942	18722	13640	3100
3200	8.573	20950	15670	7.995	19519	14238	3200
3300	8.598	21809	16330	8.045	20320	14841	3300
3400	8.622	22670	16992	8.093	21126	15449	3400
3500	8.645	23533	17657	8.139	21937	16062	3500
3600	8.666	24399	18325	8.184	22754	16680	3600
3700	8.686	25267	18994	8.227	23575	17302	3700
3800	8.705	26136	19665	8.269	24400	17929	3800
3900	8.723	27007	20338	8.310	25229	18560	3900
4000	8.739	27880	21012	8.349	26062	19195	4000
4100	8.754	28755	21688	8.388	26899	19833	4100
4200	8.768	29630	22365	8.425	27740	20475	4200
4300	8.782	30507	23044	8.461	28584	21121	4300
4400	8.795	31386	23724	8.496	29432	21770	4400
4500	8.808	32267	24406	8.530	30283	22423	4500
4600	8.820	33149	25090	8.563	31138	23079	4600
4700	8.831	34031	25774	8.595	31997	23739	4700
4800	8.842	34915	26459	8.626	32858	24402	4800
4900	8.852	35800	27146	8.656	33722	25068	4900
5000	8.862	36686	27833	8.686	34589	25736	5000
5100	8.872	37573	28521	8.715	35459	26407	5100
5200	8.881	38461	29211	8.743	36332	27081	5200
5300	8.890	39349	29801	8.770	37207	27758	5300
5400	8.899	40237	30590	8.796	38084	28437	5400

TABLE 3 CARBON DIOXIDE AND WATER

CO_2 $M = 44.00$				H_2O $M = 18.016$			
T	C_p	H	U	C_p	H	U	T
600	9.283	547	428	8.044	481	362	600
700	9.788	1499	1181	8.136	1291	974	700
800	10.251	2502	1986	8.249	2110	1594	800
900	10.670	3550	2835	8.379	2940	2225	900
1000	11.049	4637	3724	8.523	3784	2871	1000
1100	11.392	5759	4642	8.669	4643	3532	1100
1200	11.695	6913	5603	8.821	5518	4208	1200
1300	11.970	8096	6587	8.977	6408	4899	1300
1400	12.218	9305	7598	9.136	7314	5607	1400
1500	12.445	10538	8633	9.299	8236	6331	1500
1600	12.650	11794	9690	9.464	9174	7070	1600
1700	12.832	13069	10766	9.631	10128	7825	1700
1800	13.005	14362	11861	9.799	11099	8598	1800
1900	13.159	15671	12971	9.964	12087	9388	1900
2000	13.298	16994	14096	10.127	13092	10194	2000
2100	13.425	18330	15234	10.287	14114	11018	2100
2200	13.541	19678	16383	10.443	15152	11857	2200
2300	13.648	21037	17543	10.595	16205	12712	2300
2400	13.747	22406	18714	10.742	17272	13580	2400
2500	13.839	23785	19895	10.883	18353	14463	2500
2600	13.923	25174	21085	11.019	19447	15358	2600
2700	14.002	26570	22282	11.151	20555	16267	2700
2800	14.075	27974	23488	11.274	21675	17189	2800
2900	14.142	29385	24701	11.392	22807	18123	2900
3000	14.205	30803	25920	11.505	23951	19068	3000
3100	14.264	32227	27145	11.613	25106	20025	3100
3200	14.317	33656	28376	11.717	26272	20992	3200
3300	14.369	35091	29612	11.815	27449	21970	3300
3400	14.417	36531	30854	11.910	28636	22959	3400
3500	14.460	37975	32100	12.000	29833	23958	3500
3600	14.501	39243	33349	12.086	31039	24965	3600
3700	14.539	40875	34602	12.167	32253	25980	3700
3800	14.575	42331	35860	12.244	33475	27004	3800
3900	14.610	43790	37121	12.318	34704	28035	3900
4000	14.644	45253	38385	12.388	35940	29072	4000
4100	14.677	46720	39653	12.455	37182	30116	4100
4200	14.708	48190	40925	12.519	38430	31165	4200
4300	14.739	49662	42199	12.580	39684	32221	4300
4400	14.768	51136	43475	12.639	40944	33282	4400
4500	14.797	52614	44754	12.695	42210	34349	4500
4600	14.824	54094	46035	12.748	43482	35423	4600
4700	14.850	55577	47319	12.798	44760	36502	4700
4800	14.875	57063	48607	12.846	46043	37587	4800
4900	14.899	58553	49898	12.892	47331	38676	4900
5000	14.922	60045	51192	12.935	48623	39770	5000
5100	14.944	61539	52488	12.976	49919	40868	5100
5200	14.965	63035	53785	13.015	51219	41969	5200
5300	14.984	64532	55083	13.052	52522	43073	5300
5400	15.003	66030	65383	13.088	53828	44181	5400

tables are of the author's computation, checking closely with the tables of published data. In general, the latter are not full enough in all columns for smooth interpolation.

Formulas have been proposed for C_p; but, if of full-range accuracy, they are discouragingly cumbersome, especially for the calculation of entropy. The scheme used by the author has been to break the whole curve into several sections, passing through three points of each a simple parabola of the form

$$C = A + BT + GT^2 \quad [3]$$

Then the small differences between the true curve and this formula curve can be handled by simple graphical-numerical methods with quite sufficient accuracy. In effect, the "formula" for each C_p is the numerical column of its table.

It is strongly the opinion of the author that the thermal properties of gases should be brought to expression by numerical tables, analogous to the table for superheated steam. For a gas mixture there will remain, then, a lot of routine numerical work by slide rule or calculating machine. However, the situation has the saving feature that, in most problems, only a short section or a few lines of the composite table will be needed.

In the table headings, exact values of mol weight M are given; but practically, except perhaps in the case of hydrogen, round-number divisors can be used when pound heats are desired, with 28 for nitrogen and 18 for gaseous water.

REFERENCES AND NOTES

This paper is not of the sort to call for a bibliography of the subject. Three general references will sufficiently point the way to further information; then direct references will show the location of data for the present calculation.

The best comprehensive exposition and study of the older specific-heat determination is the book, "The Specific Heats of Gases," by Partington and Shilling, 1924.

For high-range specific heats see Bulletin No. 139, Engineering Experiment Station, University of Illinois, Goodenough and Felbeck, 1924, pages 93 to 106.

The new determinations are brought to the attention of engineers, comprehensively, by Bulletin No. 2 of the Georgia School of Technology, "Empirical Specific Heat Equations Based Upon Spectroscopic Data," Sweigert and Beardsley, 1938.

Since the numerical values here tabulated come by independent calculation, based only upon the specific heats in the original papers, the following direct references are to particular pages and tables. All but one are to the *Journal of the American Chemical Society*, J.A.C.S.; the one is to the *Journal of Chemical Physics*, J.C.P. Without reproducing lengthy titles of papers, it is enough to give names of authors and institutions of origin.

N_2 and CO: Johnston and Davis, The Ohio State University, J.A.C.S., 56, 1934, page 273, Table II.

O_2: Johnston and Walker, The Ohio State University, J.A.C.S., 55, 1933, page 179, Table III, to 900 K; J.A.C.S., 57, 1935, page 683, Table I, 1000–5000 K.

H_2: Davis and Johnston, The Ohio State University, J.A.C.S., 56 1934, page 1045, Table I.

CO_2: Kassel, U. S. Bureau of Mines, J.A.C.S., 56, 1934, page 1841, Table IV.

H_2O: Gordon, University of Toronto, J.C.P., 2, 1934; page 69, Table II, to 1500 K; page 549, Table I, 1500–3000 K.

The short tabulations, Tables 4 and 5, show the specific-heat data for two gases, with parallel columns of the author's values.

TABLE 4 FULL-RANGE C_p DATA FOR CO

T deg K	Data	Calc	T deg K	Data	Calc	T deg K	Data	Calc
300	6.964	6.964	900	7.792	7.792	2500	8.807	8.808
400	7.013	7.013	1000	7.936	7.936	3000	8.900	8.899
500	7.122	7.122	1300	8.269	8.270	3500	8.964	8.965
600	7.279	7.279	1500	8.422	8.422	4000	9.016	9.016
700	7.455	7.455	1750	8.564	8.561	4500	9.060	9.060
800	7.629	7.629	2000	8.667	8.666	5000	9.099	9.101

TABLE 5 SHORT-RANGE C_p DATA FOR N_2

T deg K	Data	Calc	T deg K	Data	Calc	T deg K	Data	Calc
200	6.956	6.956	500	7.071	7.071	800	7.516	7.520
300	6.960	6.962	600	7.200	7.200	900	7.676	7.673
400	6.991	6.991	700	7.353	7.352	1000	7.821	7.821

Table 4 is better than average in closeness of agreement. Table 5 shows the greatest amount of disagreement.

MOLD RECEDING FROM TROUGH WHILE PIPE IS BEING FORMED

(Photograph taken by H. S. Hoffer and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Annual Meeting in Philadelphia.)

TOOLS *of the* PERSONNEL TRADE

By GUY W. WADSWORTH, JR.

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PERSONNEL work justifies itself as a specialty only as it produces results superior to those which can be obtained otherwise. Unless the personnel man can select better workers than would be hired by department heads, and deal more efficiently with promotions, transfers, and like problems, there may be no special virtue in centralizing personnel functions. It may result only in having all of the mistakes made in one place. If there is to be no change in the number or percentage of mistakes, supervisors would undoubtedly prefer to make their own.

The act of hiring a man carries with it the presumption that he will stay with the firm. Sooner or later his ability to perform his work and to get along in the group in which he works will become matters of first importance. This suggests critical examination of current methods of selecting workers, with a view to developing the best job of placement of which industry is capable.

The first striking feature of any study of present-day hiring methods is the paucity of recorded data specifically covering results. The plain fact is that it has not as yet become fashionable to keep individual records. Lacking these, industry accepts rather general reports on the personnel situation as indicative of success in hiring. Yet, it should be obvious that the success or failure of our employment practices, in the last analysis, comes down to individual cases. We should know how many of the so-called "sure winners," who clear the employment department, turn out actually to be such when on the job.

SPECIFICATIONS FOR A SECRETARY

The fact that few firms take the trouble to keep comprehensive records no doubt explains the prevalence of many beliefs which spring up and flourish unchallenged in the employment field. There are numerous ideas, for example, with respect to preemployment requirements of which almost any supervisor will unburden himself with moderate encouragement. In one instance, a department head asked us to review specifications for a new secretary. He showed us a full page of single-space typing, listing minimum qualifications for the job, which included high-speed transcription and typing; knowledge of law affecting securities, including all details of servicing funded debts; knowledge of corporation finance and banking practices; of customer contracts; the handling of delinquent accounts; income tax and corporation taxes, and so on. In addition, there was a long list of personal qualifications such as good appearance, neatness, charm, and personality. He was quite obviously pleased with this formidable compilation of abilities and virtues. His manner even suggested that we would probably be stumped in satisfying completely all requirements. Actually he had us there, but he solved the problem for us himself.

A day or two later he met a banker friend at a Rotary luncheon and cooked up a deal to hire the latter's daughter. She had not yet graduated from school, and was neither prepared nor experienced in a number of the particulars listed as indispensable. Nonetheless he stoutly insisted that she "came from good stock," and felt certain that she would be able to fill the bill.

This sort of guessing, less exaggerated in most instances, is quite common. Take the question of how much education or how much experience should be required in hiring applicants for given work. Almost any supervisor will tell you something if you ask his opinion on either point. Yet, barring answers related to fairly well-organized crafts or professions, you can almost always win small money on the bet that the supervisor does not know whether the requirement, as he states it, is typical either of the education or the experience of the successful workers with whom he deals every day.

Perhaps there is no field in which people seem more disposed to proceed with such complete disregard of facts which are readily available. In addition, there are rather special factors which operate to obscure information. Where the supervisor has exercised a final choice in the selection of men, it appears almost a point of honor to live with mistakes rather than to admit them. That is one reason why there have been so many unhappy surprises in recent labor relations. Supposedly satisfactory and contented workers turn up with grievances not at all typical of the happy relationship implied by the silence of the supervisor.

Personnel departments have not always been self-critical in auditing their own work. Some of them have been known to charge down upon supervisors who complain of given hirings, and to imply with some heat that "we select good men—you just don't know how to get the best out of them." Few of us, even at this juncture, have agreed upon any method whereby we can recognize a good hiring when we actually make it.

Perhaps we should definitely locate the function of calling the shot on success or failure in hiring where it belongs. Supervisors, who are charged with responsibility for results on the job, appear logically situated to perform this function. The issue should not be left entirely to the most immediate supervisor, as he may be merely protective or too close to the picture to draw any real comparisons. A balanced view on the success or failure of a hiring can be drawn from the views of several supervisors, where they are properly impressed with the necessity for careful observation, and for stating the case exactly as they see it. Results can be reduced to a count which readily shows the proportion of success and failure. Once we can measure results with some assurance, the appraisal and improvement of our hiring techniques can be objectively undertaken.

PERSONAL-INTERVIEW METHOD OF HIRING

The hiring method in most widespread use is the personal interview. Two types of interview may be described briefly. The first is a general "sizing-up" process, in which the interviewer relies chiefly upon his own (innate or acquired) ability to judge men. Second, there is the so-called objective interview, in which the purpose is to question the applicant on a limited number of points believed to be criteria of fitness for the job. In the first case, the interviewer more or less frankly relies upon his personal impressions. Under the second approach the interviewer tries to rule out his personal impressions and to consider the applicant solely in terms of standards. Probably elements of each approach operate in the other, and

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the only real distinction lies in the degree of reliance consciously placed upon personal impressions.

The case for and against the interview has been reviewed at length in personnel literature. Those who use it usually decide for or against the applicant at the conclusion of the interview, and make the decision with definite conviction. If results are highly valid, the interview has the appeal of a direct and positive approach.

The classic experiment on the validity of the personal interview was performed by Hollingworth of Columbia University. He prevailed upon a group of executives, who were experienced in hiring men, to review some 60 candidates applying for the same job. He asked these executives to interview the applicants and then list them in order of their relative desirability for the position. Hollingworth's thesis was, that if there is such a thing as innate or acquired ability to judge men, then people who presumably possess that ability should reach fairly common agreement when reviewing the same group of candidates.

Actually, one applicant received first, second, fifty-third, and fifty-seventh places in order of desirability from various interviewers. The applicant who was given the best average standing was ranked all the way from second to thirty-sixth place. The two applicants who received the worst rankings ranged from sixth to fifty-fifth place.[1] Instead of narrowing the field down to a few logical choices, the confusion of choices increased with the number of interviewers. The names of the applicants could have been placed in a hat and thrown downstairs, with the statistical chances as good as any other that the name landing on the highest step would prove to be the common choice.

Variations of this experiment have been performed since, almost uniformly with the same result. Unless the applicant offends some popular idea of what is unfavorable in physical appearance, the use of the personal interview ordinarily means that, as between applicants with relatively the same education and experience, one interviewer will take one of the candidates, while another interviewer will take someone else.

"READING" THE CANDIDATE'S CHARACTER

There is no question that popular beliefs with regard to personal appearance are of great influence in the hiring situation. There are numerous accepted ideas on "reading people," such as the "honest face," the "intelligent forehead," the "weak chin," and the "shifting eye." These encourage or warn us, as the case may be. No doubt, the dispositions of a number of people with red hair are considerably affected by the popular expectation that they should be hot-tempered and hard to get along with. The popular disposition to believe things of this kind explains the acceptance of many so-called systems for analyzing people.

The whole school of phrenology, for example, long since discredited, was based on the superficially plausible thesis that the human brain is like a muscle, and will expand in the areas most often put in use, with corresponding changes in the shape of the skull. Dr. Galton gave us a theory of "localizations" of the brain, taking the trouble to develop a chart of the head to show us where various functions were located. A high crown on the skull, symbolic of the mind reaching heavenward, was supposed to indicate a disposition to be reverent. Other functions, such as music, language, and histrionic ability were supposedly localized beneath the eyebrows. To indicate that this was an ancient and honorable science, "amativeness" (or sexuality, to you) was modestly located at the back of the head in the occipital lobe.

Franz and Lashley exploded this theory by the expedient of examining cases of brain injury. They took the position that, if functions are localized, then, if the brain is injured in a given area, the function supposedly located in that part of the brain should be impaired. With the advent of the automobile, they were able to secure and to examine a large number of cases of brain injury. Their finding was that the brain, instead of being localized as to functions, in reality presented a host of interoperative mechanisms. The so-called bump of reverence or veneration was found to be located over the great fissure. When that area of the brain is impaired, there is loss of motor function, particularly in the ability to wiggle the great toe. In one case, an individual who had lost almost half of his brain in an accident, but miraculously had survived, was reeducated by Franz to perform most of the functions typical of normal individuals.

Another popular theory was the so-called Blackford system which was highly complimentary to individuals of blond persuasion. Miss Blackford started with the premise that blond people had developed in the harsh and cruel northern climates. Brunettes were supposed to have originated in torrid climates where life was easy. The result, according to Miss Blackford, was that "always and everywhere, the normal blond has positive, dynamic, driving, aggressive, domineering, impatient, active, quick, hopeful, speculative, changeable, and variety-loving characteristics; while the normal brunette has negative, static, conservative, imitative, submissive, cautious, painstaking, plodding, slow, deliberate, etc., characteristics." All went well with this theory until someone (presumably a brunette) with a penchant for scientific research, examined the characteristics of a large group of blonds and of a large group of brunettes. It was found that, by all available testimony, 64 per cent of the brunettes possessed blond traits in the same degree as blonds themselves, and vice versa.[2]

Numerous researches of like nature and outcome could be cited if space would permit. The chief importance of physical signs to our discussion is the great reliance upon them which unquestionably figures in the selection of employees by the personal-interview method. Neither the interview as a whole nor interpretations of personal appearance are techniques which have been fully validated by accepted quantitative methods. Following a review of these facts, however, someone usually asks: "But don't you *really* believe that some people are rather specially good at sizing up other people?" We can only answer that it is not a question of what we *believe*. Where anyone appears to have an unusual record of success with the so-called sizing-up process, we should resort to pay-roll records and scan the list of all selections he has made from a cold start. By this simple expedient, particularly when the success or failure of each selection is left up to supervisors who were not party to the choice, we can determine the exact basis for any claim to excellence. In the process we may turn up a few surprises.

EXAMINATION TECHNIQUES

Examination techniques, including psychological testing, have been used in both public and private employment. This approach is worthy of investigation, because those who use this method are inclined to count cases and to record their findings.

Two general types of testing are in current use. The most common is the trade test, or so-called "practical test." Its object is to test the applicant in the clerical or mechanical operations called for on the job. This has a logical appeal, but there is no very convincing evidence that trade tests, by them-

[1] "Judging Human Character," by H. L. Hollingworth, D. Appleton-Century Company, Inc., New York, N. Y., 1922, p. 62.

[2] "Physique and Intellect," by Donald G. Paterson, D. Appleton-Century Company, Inc., New York, N. Y., 1930, p. 214.

selves, operate to assure good selections. There are numerous reasons why the best service a trade test can offer is essentially a limited one.

Consisting usually of questions drawn directly from the trade or occupation, a premium is automatically placed upon experience, often to the neglect of potential ability. The showing in trade tests may accurately reflect the relative abilities of applicants as they stand on the day the test is taken. It has been a common finding, however, that while those who make the top scores in a trade test outshine their competitors in the early course of employment, their superiority does not necessarily continue. As those who made lower grades gain experience, differences in actual performance on the job tend to level off. An exacting examination which penalizes inexperience may not furnish distinctions which truly indicate who will ultimately, or even in the fairly immediate future, show the greatest skill in actually doing the work. If the business is situated at all times to bid for the highest of journeyman skill, a valid trade test is of some assistance in selection. They are of less value in those industries which train their own workers from scratch.

The chief weakness of trade and practical tests is that the issue of long-term success or failure on the job is not necessarily a question of occupational skill. In investigating more than 400 discharges for cause in one large firm, it was found that failure in clerical, technical, or mechanical operations figured in less than 8 per cent of the cases. Even in the discharges where failure in the work was a factor, it was seldom a lack of the basic skill presumably sampled in the trade tests. Failure to use the skill which the employee actually possessed was the more frequent cause. The breakdown of selection work in these cases was chargeable, not to lack of occupational skill, but to failure to deliver.

In passing, it may be remarked that much which goes on under the heading of "practical" testing is such in name only. There are a few well-prepared and validated practical trade tests which have been developed under controlled experimentation, and which meet the standards of good testing practice. It does not follow that anyone who can think up some questions has a valid test to show for it. Beyond this, discovery of basic skills and aptitudes represents only a starter in the task of successful selection. As a rule, businesses have had little trouble with the skill of the American workman. We must identify and place that skill where it belongs, but in the main, our problem is to develop a harmonious and mutually profitable long-term relationship. We cannot begin and end our thinking on the task of selection with the issue of whether or not a man will be able to drive a nail straight while we are watching him.

VALUE OF PSYCHOLOGY TESTS

Psychological testing, which is admittedly less common than trade testing, deals primarily with the mental and temperamental adjustment of the worker to his job. The basic assumption is that, if the workers who succeed in given occupations possess certain characteristics which can be measured, then, if we limit our hirings to applicants who have the same characteristics by measurement, we shall increase the proportion of success in hiring. Stated otherwise, the procedure is to measure employees of known success, and then try to find applicants who are like the employees who make good.

This sounds a bit more simple than it really is. Actually, it is almost impossible even to discuss the subject of testing without running head on into opinions and prejudices, which, although not often based upon direct personal experience, are nonetheless emphatic. As Laird has stated, many people think that psychological testing means asking "if Mozart was a violin player or a race horse; if a revenue cutter is used on a milling machine or a lathe; or if Anatole France is a summer resort, a state, or a man." From the academic field, sweeping pronouncements occasionally make news under the heading of "what most psychologists and educators think" of given tests. Many of these statements are not based upon any recorded sampling of opinion to which one can be referred by page and paragraph. Speculation on this subject has even invaded the practical business world, where some executives have resolved the case for or against testing by reading sets of questions to see how many they can answer, themselves.

Actually, there are about six comprehensive commercial-testing programs in the United States, in which psychological tests have been used long enough, and in which results have been followed consistently enough, to gain any idea of what these tests will do. In addition, eighteen fairly large firms use one or more psychological tests, with partial reliance upon results. While the total group is numerically small, it includes firms of consequence such as Scovill Manufacturing Company, The Pennsylvania Company, Philadelphia Electric, Procter and Gamble, branches of General Electric, Atlantic Refining, Eastman Kodak, Macy's, and so on. It is significant that these firms, after carefully observed periods of trial, are not only maintaining but extending the use of testing in their personnel programs.

It may also come as a surprise that some of the best and most consistent results with psychological testing in industry have been achieved with so-called intelligence tests. Where mental-ability or intelligence-test standing of employees already on the pay roll has been compared with success on the job in any substantial number of cases, several important relationships have been discovered which may profitably be observed in hiring new employees.

The first and most common finding in testing a working force is that there are rather striking similarities in the mental-ability scores of employees engaged in the same line of work. In a number of occupations, scores are so closely clustered as to indicate both high and low limits in the range of selection. Direct study of employees on the job thus suggests that some factor, analogous to water seeking its level, so operates that people tend to gravitate toward lines of work to which they are intellectually suited. This is further illustrated by studying cases of employees who have been tried first in one line of work, and then another, until they have finally hit their stride in some given job. Oftener than not, this drift has been in accordance with the mental ability of the employee. This expensive process could be cut short if we had a measurement in the first instance.

STUDYING OCCUPATIONAL INTELLIGENCE LEVELS

There is, of course, nothing new in the study of occupational intelligence levels. We need not only a fairly accurate measure of mental ability, but must know how much or how little intelligence is typical of the worker who succeeds in the given job. Failure to observe these fundamentals no doubt accounts for a number of unsuccessful experiences with intelligence testing. It is not difficult to establish that measurements of mental capacity by intelligence tests prove out accurately more often than home-grown estimates based upon a few minutes of private conversation. The most common misapplication of these tests, however, is their use without some knowledge of the scores made by employees of known success already on the job.

All too often, it is assumed that the "higher the score, the better the applicant." As a result totally unsuitable people are placed on the job and, of course, do not work out well. Unless there are standards developed within the immediate company,

or drawn from comparable industries, intelligence tests may offer merely a new way to commit old blunders.

A second basic relationship is observed in comparing the employee's mental-ability-test standing with his standing on the job. Having discovered that we can define test scores for various occupations, what scores are most significant within the ranges so delimited? Are applicants who score high within a favorable range likely to work out any better on the job than those who make average or low scores? An answer to these questions was developed by having supervisors, who knew nothing of test results, rank their men in "general-value" order in small groups. The ranking of the same employees in test scores was then compared with supervisors' estimates of value in 733 cases. In 63 per cent of the cases, "score rank" and "value rank" were identical. In 20 per cent more, comparisons differed by not more than one rank, i.e., instead of "number three in score rank" being ranked as "number three in value," the value rank would be "number four." While agreement was not complete, there were two significant indications. One was that supervisors, who knew nothing of test results, recognized much the same differences in the ability of workers as were indicated by their intelligence-test scores. The other finding was a "direction of value" in terms of the scores. Within the acceptable range, the better workers were generally those with the higher scores. Exceptions were almost invariably in ultrahigh- or ultralow-score cases, on the fringe of the common range for the occupation.

The third significant relationship noted in the use of mental-ability tests is a sharp distinction between the scores of the "most successful" and "least successful" employees. Supervisors have been required, in returning individual ratings, to distinguish the "superior employee" from those who were not making good, in several thousand cases. The scores of the highly successful workers were then compared with those made by the unsuccessful group. Not only were there differences between the scores of the two groups, but the probable success in hiring at any given point in the total score range could be predicted. Where curves representing distributions of scores in these groups intersected, it was graphically apparent that applicants who had scored above this critical point had furnished 70 to 80 per cent of the company's successful hiring experience. Conversely, those who scored below the point of intersection were the most frequent failures. Stated in chances, these studies enabled us to identify the portion of the score range in which chances of success in hiring were 4 out of 5. Hiring below the critical point, we could expect success in only 1 hiring in 5.

RESULTS OF HIRING BY MENTAL-ABILITY-TEST STANDARDS

Observance of these relationships and findings over an 8-year period, in one company with over 1000 employees, has produced the following results: The proportion of applicants who prove to be highly successful on the job has increased by 50 per cent over results formerly achieved without tests. The proportion of unsuccessful hirings has been reduced five sixths by comparison with nontest methods. Applied to the problem of ruling out the applicant who will not fit the job, repeated checkups through rating procedure, where the supervisors call the shot on success or failure from year to year, show that less than one tested applicant in 10 fails to work out on the job. Exact percentages of unsuccessful hiring from 1934 through 1937, as indicated by ratings were: 1934, 5.5 per cent; 1935, 9.2 per cent; 1936, 6.2 per cent; 1937, 8.6 per cent, and 1938, 9.2 per cent. In short, results of test hiring, as determined by supervisor ratings of the employees so selected from year to year, remain relatively consistent.

We observe and accept the service performed by intelligence tests without attempting to explain them. We do not know just what they measure. We agree that they "do not look like they would do the job." The fact, however, as has been stated by a personnel manager in an important eastern firm, is: "A twenty-minute test is furnishing distinctions for us which heretofore were discovered only through the painful process of hiring and weeding out, sometimes over a two or three-year period."

In passing, one general feature of mental-ability tests deserves brief mention. So far as we can determine, they do not penalize lack of schooling. Properly devised, an occupational-intelligence standard is based upon the mental ability of the men on the job, just as we find it. If the mental level represented in a given line of work is below the average of the general population, then the standard for hiring should be correspondingly below average. There are places within industry for practically every mental level which can be measured. The use of testing enables us to avoid the mistake of placing workers far below or far above an appropriate level.

MEASURING PERSONALITY

Measurement of personality or temperament is of interest because success so frequently depends upon adjustment of the worker to fellow employees, and to the working environment, rather than strictly upon technical skill. When supervisors are permitted to analyze success or failure in their own words, their most frequent comment has to do with the worker's habits, attitudes, cooperativeness (or lack of it), and disposition to perform up to his capabilities. There is considerable evidence that successful adjustment to a job calls into play much of the same abilities as those which enable an individual to adjust to a social situation of any kind. There is no essential difference between misunderstandings among employees and those which occur in any other situation in which people get together. A working relationship, in which employees rub noses daily under force of economic necessity, would logically require fundamental compatability far beyond that needed in casual social contacts, which we can take or let alone. People do not "settle their differences off the job." They merely endure them until some pent-up resentment gets out of hand. Then we have a "labor problem."

Whenever we mention personality, our most immediate association is with "How to Make Friends and Influence People," or we think of the last salesman whose winning ways induced us to buy something we did not want. Just as we have been quick to accept systems for sizing-up people, some of us jump at methods of changing and improving personality. Actually, the scientific study of human behavior has gone little beyond the painstaking identification of a few characteristics and efforts to describe their effect upon our conduct. Personality measurement deals with tendencies and predispositions but offers no panacea for undesirable faults. The thesis merely is that, if we can determine the basic reaction pattern within which our impulses operate, we can predict behavior. We start with diagnosis, so that we can distinguish good risks from poor ones. We do not yet know much about how to effect a cure.

At its present state of development, personality or temperamental measurement can determine the presence or absence of certain traits which operate in groups and which are important to job success. First, there is a group of traits associated with self-control, rational balance, durability of mind, and conservatism, which enables us to maintain our impulses and reactions within normal limits. This braking power or control mechanism spells the difference between acceptable and unacceptable behavior in many situations. Without reasonable self-restraint, an individual's temper runs wild, his hatreds are given

free play, his egotism knows no bounds. We say of such people that they "lose their heads," "blow up in a crisis," or that they "cannot think straight about anything in which they figure personally." Fortunately, current temperamental measurement can identify the individual who is adequately equipped to hold his impulses in check as well as those who are not well-endowed in this regard. In less elegant terms, we can identify the probable "hotheads," often the "soreheads," and sometimes the potential "swell heads." Essentially, we are merely assuring ourselves that the man who enters our employ can adjust himself to the average working situation without fuss or fury.

Another important group of traits is associated with the so-called instinct of self-preservation. All of us are selfish and inclined to serve our own interests to some degree. Certain individuals, more than others, will not move out of their tracks, until they see what they are "going to get out of it." People whose self-concern gets out of bounds achieve their own purposes at the expense of the other fellow, or of society in general, if need be. They are willing to ride on the efforts of fellow workers. In some instances, they become antisocial and lacking in compunction. On the job, supervisors say that they "look for the easy things to do," complain that they "hang back," and merely do enough to "get by." Sometimes, antisocial characteristics are carried to the point of cheating, lying, wheedling, scheming, and malingering. The fundamental difficulty is that the ethical sensibilities and the sense of social responsibility which is normal to mature human beings have remained undeveloped. Such individuals have juvenile minds and refuse to grow up. The attitude is infantile, whether it exists in a small child or in a man 40 years of age. There is trouble waiting at the crossroads for any group which includes individuals in whom these traits predominate. They do not fit into organizations where reasonable willingness to work is an essential.

A third group of traits which can be measured has to do with the emotions, and particularly with the "highs" and "lows" experienced when people react to situations, and to other people, as they happen to feel at the moment. Where emotionality is marked, the individual tends to be either "shouting to Heaven," or "grieved to death." They are about to "take the town by storm," or "all is lost save honor." Among salesmen, these characteristics elicit the comment that "he goes great guns when he's hot, but you have to light a fire under him every Thursday." In ordinary occupations, the hyperemotional individual only does his best work when he "feels right." Those associated with him can only pray that all of the stars will be in proper conformation when his ability is most needed.

All of us are emotional to some degree, but extremes of emotional fervor, whether of elation or depression, merely illustrate the old adage that "what goes up must come down." Temperamental measurement enables us to identify the individuals in whom wide variations in the emotional set may be expected. They are likely to be a total loss in the slow, plodding, methodical occupations. A person moderately endowed with emotionality is an asset in meeting the public, because most of them like people. Their friendliness is an asset to the employer. Their extremes of excitability and pressure of activity are the chief drawback.

Two groups of introvert traits of opposite character can be measured. One is noted in the shy, retiring, and bashful individual who is "all right if you know him," but who is very hard to know. Such individuals tend to suspect others of not thinking well of them, look for social rebuffs, and feel pitifully inadequate in dealings which involve getting along with other people. They personalize experience, indicating beliefs such as: "God sent the rain to spoil my new hat," or "I will not go to see my school play football, because they always lose when I attend the game" (and believe it, mind you). They succeed in such work as inspectorships, or other individual undertakings. They are steady-going and able to concentrate effectively. Temperamental measurement enables us to identify them and to keep them out of assignments in conflict with their fundamental make-up.

The other type of introvert is the person who, on the basis of arrogance, conceit, and contempt for the opinions of others, sets himself apart from his fellows, feeling that the average person is neither interesting nor worth while. Such individuals are often intolerant and argue "at the drop of a hat." They are of value in any line of work calling for persistence and constancy of purpose, even when their job is not a popular one. They are the crusaders, campaigners, and avowed friends of the underdog. Often convincing in their oratory, the pay-off comes when there is close examination of the personal and human side of their partisanship. In many instances, they have no use for the people for whom they argue, but only in the rhetorical possibilities offered by a "cause." Their chief value lies in ability to take sides and to hold on, long after the average person would quit.

IMPROVE SELECTION METHODS

This thumbnail sketch is limited to the more outstanding and extreme variations observed in the study of temperamental behavior. We have attempted no schematic presentation but have merely tried briefly to indicate the character of problems which can be avoided, or solved in part, through use of temperamental tests. The case has been well stated by one personnel authority, as follows: "When one comes down to basic causes, most problems of disturbed employee relations . . . are due to hiring the wrong employee. . . . Most personnel men find themselves saddled with a perpetual job of tinkering and patching, to try to fit human beings into relationships to other human beings and to their jobs, when many of the people right from the beginning were lacking in the necessary capacities to do the jobs properly, and in many cases had temperamental kinks, emotional instabilities, conceits, egotisms, and persecution complexes which make any rational human relationships to boss and fellow worker impossible."

When it first became apparent that "the public be damned" was not a good motto or frame of mind in which to conduct a business, American industry developed concepts of "public relations." At the outset this took the form of a special activity, more or less outside the main stream of business, in which some personable executive specialized in efforts to make friends for the firm. Later on it became evident that if the public reaction to thousands of individual contacts in transacting regular business were not, on the whole, favorable, there was no magic process whereby even an able public-relations man could correct a bad public impression. Today, most of our effort in the field of public relations is to develop the ability of employees to serve the public capably in day-to-day contacts.

A parallel may be suggested in connection with industrial relations. Once wages, hours, and working conditions are in order the situation will come down to the individual adjustment of employees to their jobs. One hardly needs to belabor the point that the man who is unsuccessful in his job is a source of acrimony and disharmony. His effect on the working group may be similar to that of one spoiled apple in a barrel. There is no sleight-of-hand performance which can better a relationship which is unsound from the outset. Improvement of selection techniques is the only apparent route to avoidance of those situations in which employers and employees must, on occasion, eat crow and like it.

RAILWAY-CAR ENGINEERING

By D. S. ELLIS

CHIEF MECHANICAL OFFICER, CHESAPEAKE AND OHIO RAILWAY COMPANY

THE COMPETITION which has developed through other sources of transportation has stimulated experiment by the railroads in all directions, promising improvements in operation, in terminal facilities, and in the vehicles of traffic, both passenger and freight. In so far as these changes may have contributed to economy and efficiency, they may be regarded as permanent and, therefore, worthy of study and further development in order that the maximum advantage may be obtained in the interest alike of the shippers, the traveling public, and the railroads. It may be reasonably concluded that economy, convenience, and facility will dictate the particular form of transportation which will be utilized. For this reason the passenger automobile is in general unlikely to be supplanted by any form of railroad transportation for relatively short distances. The exception to this principle may be found in the passenger bus and, in certain congested areas, the rail motorcar. The same factors which prompt this conclusion may also be applied to commodity shipments for short distances and to a limited degree for relatively longer distances in the more densely populated areas. There is general acceptance of the view that long-distance and mass transportation must still depend upon the railroads. Therefore, the means required to provide this transportation must continue to be a subject for continuing and intensive effort on the part not only of the railroads themselves, but of all other interests concerned in producing this transportation by the most efficient, economical, and progressive means. For these reasons, the vehicles of transportation assume a place of major importance in the problems, and the principles of engineering involved in their production, therefore, become a subject of first magnitude both to the railroads and to the car-building industries.

EFFECT OF AUTOMOBILE ON RAIL PASSENGER TRAFFIC

Because the influence of the private automobile upon passenger traffic resulted in a marked decrease in earnings, it was natural that this aspect of the transportation problem should receive first consideration. Many schemes were advocated which would attempt to recapture this traffic through special forms of rail transportation. Such measures as were adopted in response to these views have in general confirmed the opinion that the most promising field for the promotion of patronage is long-distance or intercity traffic, where, except for rolling stock, existing facilities may be utilized with a minimum of expenditure for improvements without requiring major changes in equipment or operating methods.

While there is a question as to whether or not passenger-train speeds may have exceeded a reasonable upper limit, the fact is that in the past those forms of transportation providing the greatest speed have found the highest public favor. From this fact, it may be concluded that the recent tendency toward reduced net passenger-train-operating schedules will continue for both long and short distances. It is probably safe to assume that for comparatively short distances, because of the necessity of locating airports at considerable distances from commercial centers, short-distance competition from air travel can be satisfactorily met with rail schedules maintained on a practical accelerated-speed basis.

Contributed by the Railroad Division and presented at the Annual Meeting of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Philadelphia, Pa., December 4–8, 1939.

ADVANTAGE OF TRAVELING BY RAIL

Because of the competition for passenger travel from airplanes and buses, it has become more necessary than ever before to consider what appeal may be made to the traveling public in answer to this competition and to that of the private automobile. There are certain obvious advantages to be gained from travel on railroads, these are (1) safety, (2) comfort, and (3) relatively low cost. When to these advantages the elements of speed and appearance are added, an effective form of competition is obtained. These requirements involve numerous engineering problems, in the solution of which the results of research in materials and methods elsewhere form an indispensable part. As a result, important developments have occurred which have produced a new era in car design and methods of construction. Summarized, these are as follows:

1 New and improved construction materials, such as:
   (*a*) Aluminum alloys
   (*b*) Low-alloy, high-tensile steels
   (*c*) Stainless steels.

2 Modernized methods of fabrication in which welding by the arc, shot, and spot systems are used in place of the usual riveted construction.

3 Consideration of transporting excess dead weight and the utilization of structural sections, designed and applied without detracting from safe and sound construction.

4 Reduction of weight where possible by the use of metal alloys of adequate strength, tending to reduce the destructive forces of kinetic energy in case of accident.

5 Consideration of higher speeds and the coordination of brake and signal equipments to stop the train within the required distance.

6 The selection of properly designed trucks and truck parts to provide:
   (*a*) Safety of operation at required speeds
   (*b*) Comfort in riding for passenger cars by use of different combinations of springs and shock absorbers, and protection to lading in freight cars
   (*c*) Dissipation of excess noises.

7 Standards of comfort, such as:
   (*a*) Freedom from jolts and bad starts
   (*b*) Comfort in temperature and humidity
   (*c*) Well-proportioned and restful upholstered seats and lounges
   (*d*) Eye comfort in coloring of interior decoration and furnishings
   (*e*) Well-directed lighting
   (*f*) Comfort in stopping from whatever high speed the train may be operated in a distance which is consistent with high scheduled speed.

IMPROVED MATERIALS FOR CAR CONSTRUCTION

In the production of improved materials for car construction, important researches have been conducted by the steel and aluminum interests. As a result, materials having higher

TABLE 1 PHYSICAL PROPERTIES OF MATERIALS

Trade name	Kind of finished material	Heat-treatment	Physical properties: Tensile strength, lb per sq in.	Yield point, lb per sq in.	Elongation in 2 in., per cent	Reduction in area, per cent
Stainless 18-8 high tensile	Sheets and strips	Cold-rolled, reduced	150000 ult	110000	9	....
Stainless 18-8	Angles, shapes, and bars	As rolled	90000 ult	45000	55 to 60	....
Corten	Plates, shapes, and bars	As rolled (up to 3/4 in.)	70000 min	50000 min	22	....
Corten	Sheets and strips, up to 3/16 in. thick	Normalized or annealed	65000	50000	22	....
Mayari R	Plates, shapes, and bars 1/2 in. and less thick	As rolled	65000 min	50000 min	1500000 / Tensile in 8 in.	50 min
Yoloy	Plates, shapes, and bars 1/2 in. and over	As rolled	65000 to 95000	0.7 × tensile	38 to 24	....
Aluminum 17ST	Plates, angles, channels	Heat-treated	60000 ult	37000	22	....
Aluminum A17ST	Carlines, posts, purlines, window headers, belt rail, floor beams, side sill, extruded sections, and sheets	Heat-treated	43000 ult	24000	27	....
Aluminum 53ST5	Window sash and interior trim and side sheet, and extrusions	Heat-treated	39000 ult	33000	20	....
Aluminum 4S, 1/2 hard	Roof sheets and girder sheets	Not heat-treated	34000 ult	27000	12	....
Aluminum 61ST	Plates, sheets, and extruded sections	Heat-treated	45000 ult	39000	12	....

physical properties have been developed without any sacrifice of ductility, weldability, or other properties peculiarly favorable to car construction. The properties of those alloys which have thus far been utilized in car construction are shown in Table 1. There are numerous other alloys having similar properties, some or all of which are likely to be used in future car construction.

The service conditions surrounding railroad-equipment design require that the structures developed shall provide for live loads on the floor, for torsional stresses introduced by couples applied at the bolster centers and side-bearing attachments, and for impacts occurring not only under service conditions but for those which may arise from abnormal conditions. The ideal structure to resist the forces arising from these conditions with a minimum weight would be a cylinder with such modifications in form as are necessary to satisfy the requirements for floor space, window openings, carriage of equipment, and for convenient entrance to and exit from the vehicle.

The development of air conditioning has made possible a departure from older standards of construction where satisfactory atmospheric conditions within the vehicle required the maximum of height between the floor and the roof, as well as the application of a clerestory. Air conditioning involves no such limitations, with the result that headroom can be reduced, the clerestory omitted, and a simplified roof construction employed from which greatly increased strength can be secured with a substantial reduction in weight, and a closer approximation to the cylindrical construction obtained.

The chief problem is involved in providing resistance to impacts occurring under abnormal conditions. In this connection, it is necessary to consider the possibility of the movement of passenger cars associated with cars both with and without buffer mechanisms. The tendency in recent passenger-vehicle design has been to eliminate the buffer in order to accomplish weight reduction, as well as to eliminate the noise which is a necessary accompaniment of any buffer mechanism having the required flexibility. A substitute for the usual type of buffer mechanism has, however, been provided in connection with the modern types of vestibule closures, designed to secure the streamlined appearance characteristic of all recent examples of passenger-car construction.

The incorporation in the structure of the alloy steels, to which reference has been made, coupled with spot- or shot-weld methods of assembly, has made possible a distribution of material throughout the structure which produces a maximum of strength with a minimum of weight. This is not possible with carbon steels or with the conventional methods of construction involving the use of standard shapes and riveted connections.

The extent to which it has been possible to realize the maximum advantage from these materials and methods of fabrication is indicated by static tests which were recently made on a new car of modern design, wherein 954,000 lb were applied to the coupler, producing a deflection of but 0.9 in.

STREAMLINING TO SAVE POWER

Since higher net speeds have been sought in connection with all recent examples of passenger-vehicle design, it has been necessary to consider the factors producing a minimum of resistance. As it has been developed that resistance increases with the cube of the speed and varies with individual units, it was found necessary to give particular attention to the contour of passenger vehicles in order that the effects of wind velocity might be reduced to a minimum. This has been accomplished through the application of skirts to the bottoms of cars and by the elimination of openings between them; also by the elimination of surface depressions occasioned by window and other openings. It has been demonstrated that, through the streamlining methods now employed, it is possible to produce large savings in power and substantial operating economies. Coincident with departures from the older conventional designs, it has been possible to effect desirable changes in appearance, thus introducing a new factor in modern appeal for passenger traffic.

Concurrent with these changes, developments have also been made in the interior arrangement, furnishing, fittings, and lighting effects, all of which are designed to provide the maximum of comfort and convenience, coupled with an attractive appearance.

The fact that the problems involved in these developments have attracted different interests has resulted in individual treatment of different units which is inconsistent with low-cost production. It is suggested that experiment might now well be abandoned in favor of uniform production methods which would result in retention of the more desirable features of construction, design, and appearance, characteristic of equipment already built, with a consequent reduction in production cost. This would tend to stimulate interest on the part of those rail-

TABLE 2 COMPARISON OF GENERAL DIMENSIONS, WEIGHTS, AND CONSTRUCTION DETAILS OF 50-TON LIGHTWEIGHT STEEL-SHEATHED BOXCARS BUILT BY VARIOUS COMPANIES, AS COMPARED WITH A.A.R. 50-TON STANDARD STEEL-SHEATHED BOXCAR

Type	P.S.C.M.[a] boxcar	A.C.&F.[b] boxcar	G.A.T.[c] boxcar	A.A.R. Standard boxcar
Date built	1938	1939	1939	1937
Inside length, ft-in	40-6	40-6	40-6	40-6
Inside width, ft-in	9-2	9-2	9-2	9-2
Inside height, ft-in	10-1/2	10	10	10
Weight of car body, lb	22700	22500	22360	29440
Weight of trucks, lb	14600	15000	15040	15760
Weight of complete car, lb	37300	37500	37400	45200
Load limit, lb	131700	131500	131600	123800
Ratio of lading to rail load, per cent	77.9	77.8	77.8	73.2
Cubic capacity, cu ft	3728	3712	3712	3712
Underframe, lb	7497	7019	6119	7879
Sides, lb	3532	3137	4177	5933
Roofs, lb	1190	1581	1449	2086
Doors, lb	527	949	950	724
Door fixtures, lb	415			556
Ends, lb	1209	1715	1649	2350
Lumber, lb	4630	4638	4340	5556
Center sills, A.A.R., Z-type	62.6 lb per ft; 11/32 in. thick; 18.4 sq in.; high-carbon O.H.S.; 36000-lb min yield point	72.4 lb per ft; 13/32 in. thick; 21.3 sq in.; O.H. steel; 30000-lb min yield point	62.6 lb per ft; 11/32 in. thick; 18.4 sq in.; high-carbon O.H.S.; 36000-lb min yield point	72.4 lb per ft; 13/32 in. thick; 21.3 sq in.; O.H. steel; 30000-lb min yield point
Materials	High-tensile, low-alloy, except center sills	High-tensile, low-alloy, except center sills	High-tensile, low-alloy, except center sills	O.H. steel and C.B. steel
Side sheets	0.05-in. high-tensile low-alloy	0.0625-in. high-tensile, low-alloy, pickled	0.0625-in. high-tensile, low-alloy	0.10-in. O.H. steel
Roof sheets	0.05-in. high-tensile, low-alloy	No. 18 gage, low-alloy, 0.050 in.	No. 16 gage, low-alloy, 0.0625 in.	No. 16 gage, 0.0625-in. O.H.S.
Door sheets	0.05-in. high-tensile, low-alloy, Pullman doors; 100 cars with Pullman and 100 cars with Creco fixtures	1/16-in. corrugated, Creco fixtures	1/16-in. Camel door, Camel fixtures	No. 13 gage, O.H. steel; Youngstown steel with Camel fixtures
End sheets, bottom	1/8-in. high-tensile, low-alloy	5/32-in.	5/32-in.	1/4-in. O.H. steel
End sheets, top	3/32-in. high-tensile, low-alloy	1/8-in.	1/8-in.	3/16-in. O.H. steel
Ends	Car builder	Car builder	Dreadnaught	Dreadnaught
End plate	1/8-in. high-tensile, low-alloy	1/8-in. low-alloy	Integral with end top sheet	Integral with top sheet
Side sills	6 × 3 1/2 × 1/4-in. angle, high-tensile, low-alloy	3/16-in. pressed angle	3/16 × 10 7/8-in.	6 × 3 1/2 × 5/16-in. angle
Side-sill reinforcement	7/32-in. pressed channel; high-tensile, low-alloy	3 × 2 × 3/16-in. angle; full length	1/8-in. plate welded to side sill	6-in. 10.7-lb S.B. bulb angle
Side plate	5/32-in. pressing, high-tensile, low-alloy	3 × 2 × 3/16-in. angle	9 7/16 × 1/8-in.	3 3/8-in. 8.3-lb A.A.R. Z-bar
Construction	Welded	Welded	Welded	Riveted
Body bolster	Box section, welded top portion extends across car; bottom portion welded to center-plate filler	5/16-in. "U" section pressing	3/16-in. web with 21 × 5/16-in. top and bottom cover plates	Pressed pans, top and bottom cover plates extend across car; riveted
Center filler and back stop	Built-up; welded	Built-up	Built-up	Cast-steel
Striking casting	Built-up; welded	Built-up	Built-up	Cast-steel
Cross bearers	Built-up; welded, attached to center sill by welding	3/16-in. low-alloy	3/16-in. low-alloy	Pressed pans and top and bottom cover plates extending across car; riveted
Side posts	Z-shaped, pressed integral with sheets	1/8-in. Z-section	(28) 0.10 Z	3-in., 5.1-lb Z-bar
Floor supports	3-in. pressed Z-bars, 3 each side of center sill	3-in. 5.1-lb Z-bar	3-in. 6.7-lb Z; 4 × 3/16-in. Z	4-in. 8.2-lb or 3-in. 6.7-lb Z-bar
Carlines	Z-shaped, integral with roof sheets	3/32-in. 3 ft 5 in. centers	0.10-in.	U-shape, 5/32-in., 11 per car
Brakes	"AB"	"AB"	"AB"	"AB"
Brake beams	A.A.R. No. 15	A.A.R. No. 15	A.A.R. No. 15	A.A.R. No. 15
Brake levers	Schaefer	Schaefer	.....	Car builder
Brake-beam safety support	Angle riveted to bolster	Angle riveted to bolster	Creco 4-point	Creco 4-point support or equivalent
Brake reservoir	Lightweight, high-tensile steel	Lightweight, high-tensile steel	Standard cast reservoir	Standard cast reservoir

(*Table 2 is continued on the following page*)

[a] P.S.C.M.—Pullman Standard Car Manufacturing Company.
[b] A.C.&F.—American Car & Foundry Company.
[c] G.A.T.—General American Transportation Corporation.
NOTE: Cars of several manufacturers and A.A.R. with cast-iron wheels.

TABLE 2 COMPARISON OF GENERAL DIMENSIONS, WEIGHTS, AND CONSTRUCTION DETAILS OF 50-TON LIGHTWEIGHT STEEL-SHEATHED BOX CARS BUILT BY VARIOUS COMPANIES, AS COMPARED WITH A.A.R. 50-TON STANDARD STEEL-SHEATHED BOX CAR

(*Continued from preceding page*)

Type	P.S.C.M.[a] boxcar	A.C.&F.[b] boxcar	G.A.T.[c] boxcar	A.A.R. standard boxcar
Pipe clamps	Not used; pipe welded to underframe	U-bolt	.....	"Wright"-type or equivalent
Trucks	A.A.R. double - truss spring plankless	A.A.R. double - truss spring plankless	A.A.R. double - truss spring plankless	A.A.R. double - truss spring plank, 3 piece
Truck bolster	High-tensile, alloy-steel	Grade "B," cast-steel	Grade "B," cast-steel	Grade "B," cast-steel
Truck side frame	Grade "B," cast-steel	Grade "B," cast-steel	Grade "B," cast-steel	Grade "B," cast-steel
Wheels	Experimental lightweight chilled-iron; weight each, 695 lb (440 lb per car saving)	A.A.R. chilled-iron; 695 lb each, ground	A.A.R. chilled-iron; 695 lb each	A.A.R. chilled - iron; weight 750 lb each
Running boards	Wood	Wood, 1 1/8-in.	Steel-Apex	Wood
Brake step	Wood	Steel	Steel-Apex	Steel
Ceiling	None	1/4-in. plywood, 3-ply	None	None
Floor	1 3/4-in. fir	1 3/4-in. fir	1 3/4-in. fir	1 3/4-in. pine
Side bearings	Friction, pocket and shoe	Stucki	.....	.....
Couplers	Grade "B," A.A.R. standard	High-tensile, low-alloy cast-steel	High-tensile, low-alloy cast-steel	Grade "B," A.A.R. standard
Coupler yokes	High-tensile, lightweight	High-tensile, low-alloy cast-steel	High-tensile, low-alloy cast-steel	Grade "B," A.A.R. standard
Truck snubbers	None	Cardwell	Cardwell	Cardwell, National, Miner, or equivalent
Welding	Spot	Spot	Machine	Riveted
Hand brakes	Ajax	Ajax	Equipco	Gear and shaft, or equivalent power, types

[a] P.S.C.M.—Pullman Standard Car Manufacturing Company.
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NOTE: Cars of several manufacturers and A.A.R. with cast-iron wheels.

roads which may not have considered the introduction of the new forms of passenger vehicles now available.

APPLICATION OF IMPROVEMENTS TO FREIGHT EQUIPMENT

The improvements, which have been made in materials, design, and construction methods applicable to passenger equipment, have also been applied to a limited extent to freight equipment. These improvements have been directed mainly to weight reduction, concerning which the following claims for possible economies have been made but, to date, have not been substantiated in their entirety:

1 Saving in operating cost due to reduced tare weight, resulting also in operating longer trains with the same or less powerful motive-power units.

2 Added revenue load in each car (when loaded to the load limit), because of the corresponding reduction in the dead weight of the vehicle.

3 Possible saving in maintenance costs, especially when compared with the older types of cars.

These savings when compared with increased first costs seem to justify the use of the lighter-weight equipment.

During 1933, the Association of American Railroads (A.A.R.) had five 50-ton steel-sheathed carbon-steel riveted-construction boxcars built on which the A.A.R. Z-section center sills were used. These cars were about 3000 lb lighter than the previous conventional type and were subjected to severe impact tests of a destructive nature and withstood all tests satisfactorily. They were also subjected to road tests on different railroads with satisfactory results.

Subsequently, several hundred so-called lightweight cars have been built, which consisted of such types as hoppers, gondolas, box, refrigerators, and automobile boxcars. Many of these have incorporated, for the most part, low-alloy high-tensile steels. Welding in place of riveted construction was used to a large extent on these cars. A limited number of special-service hopper cars and tank cars have also been constructed of aluminum alloys.

With the advances which have been made in materials and engineering design, the new lightweight freight cars represent a distinct improvement over earlier types. It must be admitted that the lightweight alloy-steel cars have not been in service long enough to give full information regarding maintenance costs, but the indications are that appreciable savings will be effected.

These savings will be augmented by any relative increase in the resistance to corrosion over copper-bearing steel. Various statements have been made concerning the extent of this difference, but since these have been based mainly upon observations made as the result of atmospheric corrosion, the results likely to be obtained in coal-carrying equipment are still the subject of investigation.

Welding technique and equipment of both the manual and automatic types have been developed and improved to such an extent that reliable results are being obtained. An A.A.R. report covering impact tests up to 13 mph on a boxcar, fabricated almost entirely by arc and spot welding, showed no defects; a close inspection of 14,000 spot welds failed to disclose any indications of weakness or failure.

The welded seams and connections not only avoid overlapping construction but make possible simplifications in design which effect substantial weight savings. In addition, there are no punched rivet holes to reduce the effective cross-sectional area in tension and thus necessitate using slightly heavier sections.

It has been claimed that the average speed of freight trains today is nearly 50 per cent higher than in 1920. Many manifest freight trains are being operated on practically passenger-train schedules and speeds of 50 to 60 mph are not uncommon. This means that modern well-maintained draft gears, adequate braking equipment, and proper trucks must be provided. The foundation of the modern freight truck is the steel bolster and the steel side frame with integral journal boxes which represent years of experience and development, largely on the part of the manufacturers.

Concentric wheels, proper spring suspension, reliable brake beam suspension, and safety hangers to support the brake rigging,

in the event that any part fails, are necessary, particularly in high-speed service. Recognizing the desirability of a truck construction for freight cars having improved spring suspension and less freedom from vertical oscillations than present practice, with trucks of the conventional type utilizing coil springs, tests are now in progress with different types of trucks designed to minimize these effects and meet the exactions of modern relatively high-speed and high-load conditions.

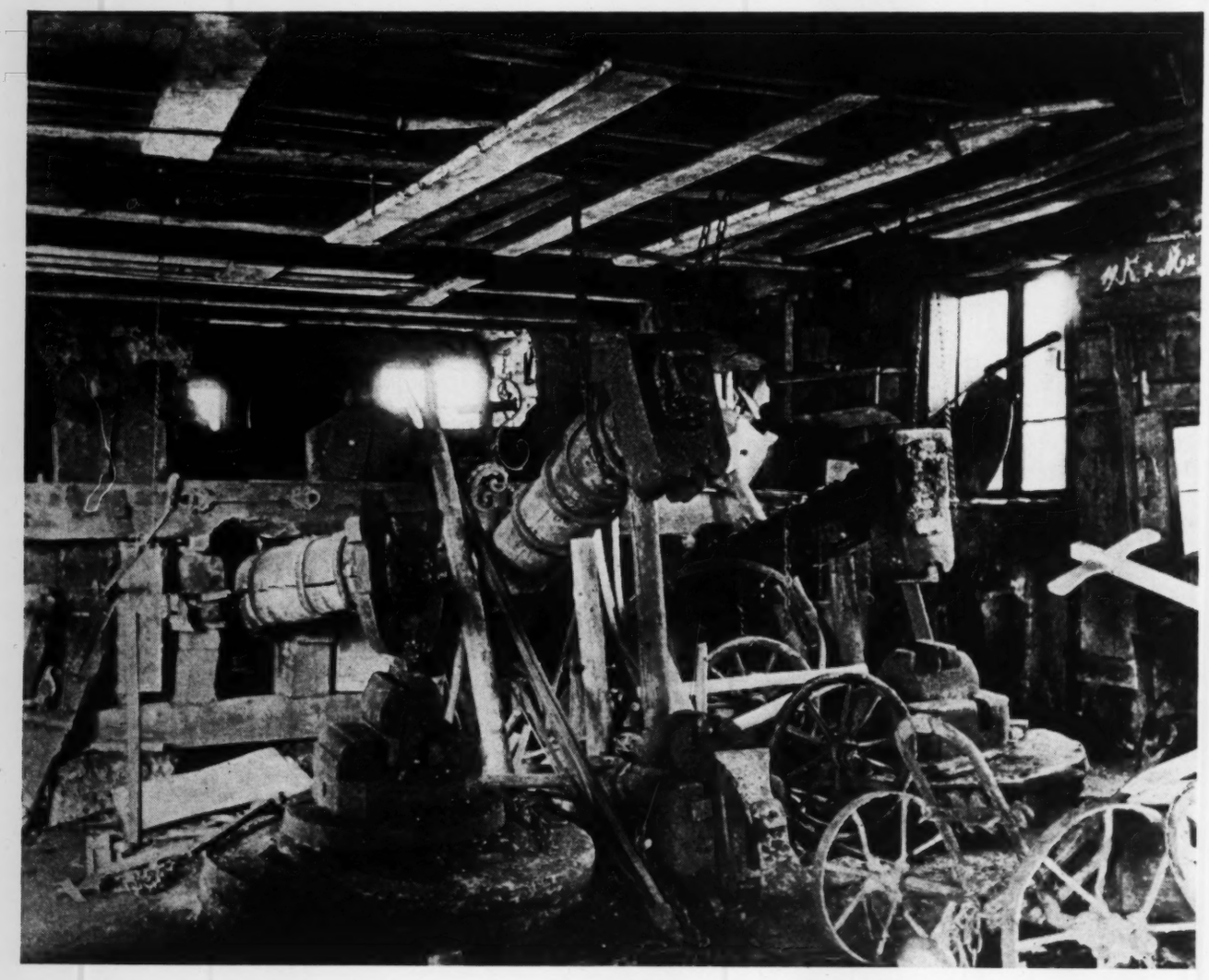
With respect to the use of alloy steels and the improvements made in various details of construction and welding practices, all of which indicate certain possibilities for economy, it is impossible at present to make a positive statement concerning these economies, due to lack of sufficient data and experience because of the comparatively short period of time lightweight cars have been in service. It will not be possible definitely to forecast what these economies may eventually be until facts concerning running repairs, maintenance, and the like, can be accurately determined over a sufficient period of time to establish the true story.

A general comparison of the most recently built lightweight boxcars, in which welding was used for a large part of the fabrication, is given in Table 2; for comparison, data on the latest A.A.R. riveted-construction boxcar are also tabulated.

CONCLUSION

The developments which have occurred in the design and construction of railroad equipment during the last few years possess advantages which will probably result in their permanent adoption, wholly or in part, for future railroad-equipment construction. In so far as passenger equipment is concerned, alloy steels with their collateral methods of fabrication will continue to be used for new passenger equipment. However, except for special service, considerations of economy in original cost and maintenance will result in the use of less expensive interiors than those which have been employed in recently built equipment.

The developments which have occurred in freight-car construction may or may not represent the ultimate possibilities in practical lightweight design. The fact that there is no background of experience from which the probable cost of maintenance of this equipment may be estimated suggests that, while utilizing some of the new alloy steels and recent methods of fabrication developed in connection with the use of these steels, any freight cars, acquired in considerable number, are likely to represent a compromise between the extreme lightweight construction and the heavy construction employed for such rolling stock in recent years.



TILT MILL OF THE 17TH CENTURY, ST. GEORGEN, BAVARIA, GERMANY

(Photograph taken by Theodore B. Hetzel and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Meeting in Philadelphia.)

LABOR SAVING AND ITS HUMAN PROBLEMS[1]

By CHARLES A. MYERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LABOR dreads few things more than labor-saving changes. The fear of layoff is perhaps the most important, but demotion, changing job requirements, overstrain, distrust, and misunderstanding are also fertile sources of labor discontent in connection with such a change. If management has mastered the purely technical aspects of an installation, its job is only partly done. There are human problems as well, and the manner in which they are handled determines the success or failure of the change.

A detailed study of several instances of labor-saving installation in an attempt to deduce "some of the more definite implications as to what the human problems of labor technology are and what tends to influence them favorably or unfavorably" has recently been completed by a professor of industrial relations in Yale University.[2] Professor Smith and his associates examined the technological changes in just one branch of one industry—"the labor saving development in cotton weaving called by management the 'multiple loom' or 'extended labor' system and by labor 'the stretch-out.'" Eighteen representative mills were studied,[3] ten of them intensively, by means of firsthand observation and interview with mill executives, union officials, workers, and townspeople. Much of the material is frankly subjective, being the author's personal conclusions from the objective data.

Recent labor-saving developments in cotton-textile weaving took place through an increase in the number of looms which weavers were required to tend. But the real problem was not simply one of requiring workers to handle more work (i.e., "labor driving"), but "in developing methods and conditions that make it possible for them to produce more without additional effort." The technological problem was inescapable. Weavers had to be relieved of unskilled tasks which they formerly performed. Loom stoppages had to be reduced by improving the yarn and tuning up the productive process generally. Auxiliary equipment was often necessary, and management had to be retrained to its new tasks. In short, a *fundamental adjustment* had to be made during the change if it was to be successful.[4] And yet, because on the surface it appeared as if no new expenditures were needed to make a "labor extension," directors and top management, pressed by the need for economies, frequently ordered increases in work assignments which were not justified by the fundamental conditions then prevailing in the plant. Violent labor reactions were usually the result.

Just as management apparently gains lower costs through increasing work loads, so labor is likely to lose its security. Here lies the root of the human problem of labor saving. Although changing market conditions made it difficult to assess the ultimate effect of these changes on employment, in nearly every mill studied, "labor saving led directly to elimination of jobs." But actual layoff was avoided in some by making the installation gradually, and absorbing the reduction in force through normal separations. In the author's opinion, "actual dismissal of qualified employees is usually preventable by qualified management and always important to prevent." Another more serious form of displacement results when methods are changed so that less skill is needed and demotion takes place. Changes in job requirements create a problem of adjustment for workers, and sometimes lead to increased hardship of work. In fact, it was the workers' fear of overstrain—"of being stretched out to cover more machines than they had the strength to handle"—that was the emotional basis for active discontent. Yet overstrain can be avoided if the "comprehensive adjustment" in labor technology is made, and this illustrates again the responsibility of management. In all but one case, "those mills which were most successful in increasing efficiency and strengthening productive organization were most successful from the human-relations point of view."

In addition to the failure of some managements to understand the need for comprehensive adjustment of productive technique before a work extension is made, there are other sources of difficulty giving rise to discontent. The pressure for lower costs is greatest during a depression, yet this is the poorest time to make a labor-saving installation. Bitter strikes occurred in four cases where pay cuts were made at the same time as technological changes. The rate at which changes are made is also extremely important. Time is needed to avoid discharges, to enable employees to understand and accept conditions, and to permit management to master the new techniques. "The average time from the start to the completion of the installation of the successful mills was treble that of the mills whose installations failed," and "mills which successfully made major installations divided them into steps." Large, revolutionary changes appeared to be necessary only when the development of labor efficiency had been neglected in the past.

In managing the installation, successful mills found that certain steps made it go more smoothly. Inefficient employees were weeded out well in advance, to reduce the displacement occurring at the time of the change. Thoroughgoing preparatory surveys were conducted to discover faults in productive and administrative organization which needed to be remedied. Then "a systematic 'tuning up' of the plant was usually undertaken," bringing conditions up to a high point and standardizing them there before actually making the installations. Further, adequate control records were necessary, to determine whether the continuance of enlarged work assignments was a hardship. And "in every successful major installation . . . .

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[1] One of a series of reviews of current economic literature affecting engineering prepared by members of the department of economics and social science, Massachusetts Institute of Technology, at the request of the Management Division of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Opinions expressed are those of the reviewer.

[2] "Technology and Labor: A Study of the Human Problems of Labor Saving," by Elliott Dunlap Smith, in collaboration with Richmond Carter Nyman, Yale University Press, New Haven, Conn., 1939, 216 pp.

[3] One of these mills was the subject of an earlier study by the author's collaborator, Richmond C. Nyman: "Union-Management Cooperation in the 'Stretch Out:' Labor Extension at the Pequot Mills," Yale University Press, New Haven, Conn., 1934.

[4] "Success" here means the installation of a labor-saving change without discontent on the part of the workers caused by discharge, demotion, overstrain, etc.

time studies were used" in setting these assignments, tempered by records of past experience and by the practical judgment of executives.

It should be clear from what has already been said that management competency is a paramount requisite in a successful labor-saving installation. Technical competency can be largely assured by the use of consultants, and all of the successful mills studied did utilize these experts. But the problem of the nontechnical aspects of labor saving—the human problem—still rests with management, and is its responsibility alone. "During the stress of a technological change, even more than under normal conditions, the primary personnel problems are hours, wages, work assignments, working and living conditions." The position of operating executives and supervisors is doubly difficult here. They must seek to understand a change which may threaten their own jobs and skills, and at the same time convey this understanding to the workers.

Adjusting management to the new requirements is, in fact, a major problem in a labor-saving installation. Old habits and ways of thinking have to be reformed. New standards, once understood and mastered, have to be maintained after the consultants have left. These experts must make sure before completing their job that "operating management is fully trained." Finally, there is the problem of preventing technically trained management from becoming so detached and impersonal that class consciousness increases among the workers.

For all these reasons, industrial relations during an installation are particularly difficult. If past relations have not been wholly satisfactory, management starts with a handicap—it has no "reservoir of confidence" upon which to draw in the trying times ahead. But "whatever the background of employee confidence may be, the problem of conveying to the employees an understanding of the present installation remains." Formal notices are too cold and detached; something more personal and thoroughgoing is needed. "Vital to employee understanding is a conviction on the part of factory management from top to bottom that sound industrial relations can rest only on a basis of openness, genuineness, and frankness."

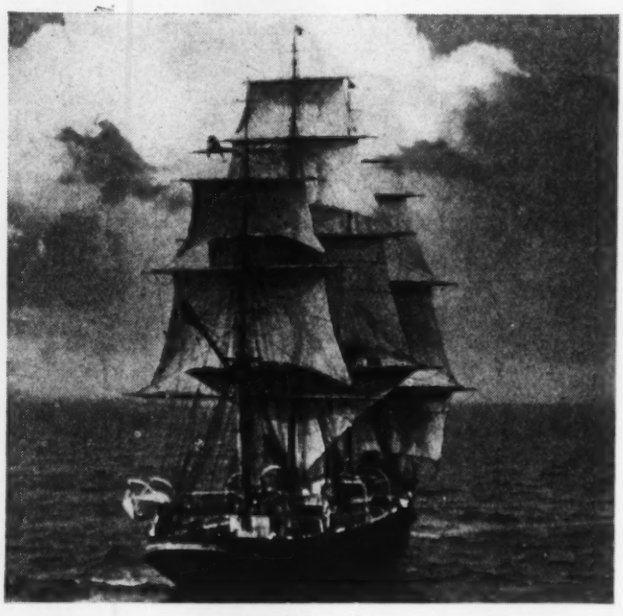
But this is not enough. Since joint problems develop, some form of collective communication between employees and management is necessary, whether through unions or work councils. "Repeatedly it was representation that enabled management to bring understanding to the employees as a whole in advance of action. Again and again it was the existence of representation that, by enabling the workers to assert their point of view, gave the management opportunity to adjust to it before that point of view had become sufficiently crystallized and violent to lead to formal demands or open rebellion. Again and again it was representation that enabled employees to secure the removal of harsh conditions and to secure the taking of safeguards without resorting to the always costly and often disastrous action of a strike."

Unless a union or some form of effective representation existed before, employees in every mill studied (with one exception) "created one for themselves during the installation by organizing a union." However, the author states that "there was no clear evidence as to whether a company plan of representation or a union was more advantageous for mill or employees during an installation." In addition to collective communication, some form of personnel management was usually found to be necessary, with consequent readjustments in management attitude.

In other directions, too, adjustments have to be made prior to and during a labor-saving installation. Extensive changes rarely occurred, in the author's experience, which did not reveal the need for "fundamental adjustments of the organization to the new development and to the conditions in the industry and nation." What had worked satisfactorily before, now gave way under the stress of a major change. "Instance after instance gave evidence that serious shortcomings anywhere, whether in operating management, labor management, technical work, merchandising, or finance, could bring disaster in spite of excellence elsewhere."

Generally, the successful mills made changes slowly, at a time of minimum financial stress and displacement, increasing work assignments in line with improved plant efficiency so that overstrain did not result, and explaining the change to their employees through collective channels every step of the way. Management was also educated to the change, adequate financing was provided for, and sales methods were altered to provide steadier operations and an outlet for the greater production. In contrast to this method the unsuccessful mills "carried existing traditions and practices forward into the new regime with little critical examination of their fitness and made only the most obvious adjustments. Above all, their action was spotty. Adjustments were made in one regard and not in another."

To enable management to guard against such mistakes in connection with labor-saving changes, the author has included in the Appendix three "check lists" of questions which should be answered before proceeding with and completing any change. These are entitled: (1) "A Check List for Deciding Whether and When to Make a Labor-Saving Change," (2) "A Check List for Managing the Installation of a Labor-Saving Change," and (3) "A Check List for Handling the Physiological Problems of a Labor-Saving Change." Careful study of these lists by management in connection with changes contemplated or actually being made in their plants should do much to reveal difficulties which need special attention if installations are to be successful. Professor Smith and his collaborators have made a distinct contribution to better industrial relations in that their suggestions, if followed, should remove many of the frictions accompanying technological change. The human problems are equally as important as the technical problems, and if this is realized, management's job should ultimately be easier.



"SAILING FREE"

(Photograph taken by L. E. Wagner and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Annual Meeting in Philadelphia.)

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context and credit to original sources is given.

Woodworking Developments

THE WOOD-WORKER

ADOPTION of a number of entirely new factors in machine design is working a revolution in many woodworking methods. These developments are described in an article by J. E. Hyler appearing in the October, 1939, issue of *The Wood-Worker*.

Air cylinders have enjoyed continually increasing application to machines and equipment used in the woodworking field. Not only are they used on bending presses, but they are used largely in various types of modern clamps. The comparative ease with which sash, doors, blinds, and other types of woodwork may be clamped up when being glued or assembled, represents a high degree of efficiency advance over former mechanical arrangements and devices. Again, the air cylinder is used for holding work on some of the modern woodworking machines. This is especially true of power-feed automatic shapers and of oscillating-bit mortisers. Doubtless this trend is in its infancy but it has already made interesting progress.

The thought of clamping brings one to a consideration of modern gluing. New glues, applicable in the form of dry sheet material, are insoluble after plywood has been laid up by their use. Such glues have demanded and obtained the perfection of an entirely new gluing technique, that of so-called hot pressing. A hot-plate press is needed for gluing up such plywood, because it takes heat to liquefy the dry sheet glue to the point where it becomes a bond. The glue is simply leaved in between the sheets of wood veneer, the assembly is placed in the press, and the heated plates brought together at a given pressure. They are held there for a specific short interval, then the sheet of plywood is removed, ready for use, a product that withstands water and other tests of great severity without any loosening or separation of the plies.

Where dry sheet glue is used in quantities there is use for a cutting machine that will allow taking from a roll of the material a sheet of the proper dimensions or area without loss of time, and such machines have been developed and are used as auxiliaries of the hot-plate press in many places. It should be noted, however, that resin glues are also available in liquid form. Some prefer to apply them by the time-honored glue-spreader method, and this works out all right in connection with the hot-plate press.

Cutterheads and cutters of various special types used in woodworking have kept close pace with the developments in steel, in so far as they have proved themselves applicable to woodworking practice and problems. There are planer knives that are plated with chromium. The use of high-speed steel has been increasing. Steel with a nickel content is used in many band-saw blades, giving additional strength. For extreme cases of cutting, where difficult and abrasive conditions are present, as in the cutting of fireproofed wood or cutting wood that has a linoleum covering applied, knives are used that are tipped with Carboloy. There are also saws in use that have the tooth points tipped with Carboloy.

Band-sawing machines in particular, as used in woodworking, have come in for close attention in recent years. Where the old method of equipping a band-saw wheel with a tire designed to offer a cushion for and to protect the teeth, consisted in stretching a rubber band in place over the rim of the wheel, then applying cement between the tire and rim, this method is being largely displaced by using demountable tires of much lighter type, having a coating of high-grade rubber vulcanized to a steel tire or core-like backbone, the rubber entirely enclosing and hiding the steel. This allows of greater speed of the wheels and still maintains proper balance. It is also far more convenient than the old method of stretching on a tire.

Drilling Small Holes

ENGINEERING

A HIGH-SPEED drilling machine for minute holes required in the injection nozzles of Diesel engines is described in *Engineering* for October 27, 1939. The machine described is the development of an Italian engineer residing in London, and was occasioned by the necessity of drilling a hole 0.001576 in. diam with its axis displaced about one half of its diameter from the axis of the nozzle. Another hole must be drilled in a rotatable cap by means of which the effective area of the combined holes can be varied from full bore to zero. Precision was a requirement of the design.

To eliminate vibration and secure variable speed, the spindle is fitted with a disk in a horizontal plane driven by a rubber-tired roller mounted on the shaft of an electric motor arranged so that the roller can be moved across the face of the disk, increasing spindle speed from zero to maximum. By means of a hand lever and quadrant the roller is positioned, and a liquid rheostat in the motor circuit affords further speed control.

The drive is transmitted to the drill through a hydraulic coupling by a combination of the centrifugal force of the fluid (petroleum) and its viscosity. The drill thus floats relatively to the spindle and can readily adjust itself to the correct alignment. Furthermore, the resistance of hard spots, likely to cause breakage of the drill if positively driven, will stop the hydraulically driven drill with less danger of breakage.

Feed pressure is applied to the spindle and not to the drill collet, and is not exerted by hand, as in the ordinary sensitive drills, but by a series of ring weights. For any given set of rings the pressure remains constant. A tabular statement enables rings to be selected in accordance with the diameter of the drill to be used.

The control is of a nature suited to delicate drills. The speed of the drill on commencing a bore must be slow and pressure light, conditions which must also obtain when the drill breaks through the metal. The speed is precisely con-

trollable by the friction drive and the pressure by adding or removing rings as desired. Feed pressure and speed may thus be exactly related.

The drilling operation may be watched through a microscope and is illuminated by an electric lamp, both of which are parts of the machine and capable of universal adjustment.

Two levers for hand operation control vertical and transverse motions of a steady rest which guides the drill. A micrometer device is provided to set the nozzle so that the hole is drilled off center as required in the design.

Pump-Propelled Lifeboat

THE ENGINEER

ONE of the features of a new surf-type, motor lifeboat completed for service in Great Britain is its propulsion units which comprise two horizontally opposed flat twin-cylinder engines driving two Gill pumps, each at one side of the boat, constructed as shown in Fig. 1. According to a description in *The Engineer*, Nov. 3, 1939, each unit consists of a short siphon casing built of copper sheet of 14-gage thickness, which contains the horizontally arranged Gill pump, and on the outlet side connects with a circular bellmouthed opening through the bottom of the boat and houses the deflecting nozzle. The pump is of the Gill standard axial-flow pattern, and is generally similar in design to the pumps now extensively employed for circulating-water duties in naval vessels and in power stations.

The action of the device may well be described as operating by accelerated siphonic flow. The water, it will be noted, is drawn in at a mean angle of about 60 deg to the water line, passes horizontally through the pump, and is discharged at a higher velocity through the contracting passages of the discharge deflector so that the stream issues in a broad and flattened form below the water line at an angle of about 15 deg. By adopting this angle of discharge, little of the horizontal-thrust component is wasted and any increase in skin resistance which might result were a high-velocity discharge to be directed along the surface of the hull is obviated. As the issuing water stream can be directed to any point of the compass, by turning the wheel mounted on the vertical spindle of the deflecting nozzle, the steersman has a full power control of the boat for making any desired maneuvers. By moving the wheel only half a turn the boat can be stopped and made to go astern. The discharge deflecting nozzle projects only slightly below the hull surface, and by means of a screw-jack attachment mounted on the steering column the deflector can be moved axially downward away from its bellmouthed housing, so that any obstructions are flushed from the deflector passages. By this means it is also possible to suspend propulsive reaction. Should it be desired to fix the jets in a fore-and-aft direction so that the boat can be steered by rudder, this is done by means of locking devices fitted on the steering spindles.

The dead pull reaction of each of the units is about 24 lb per ship bhp of engine input. This high value of stationary thrust

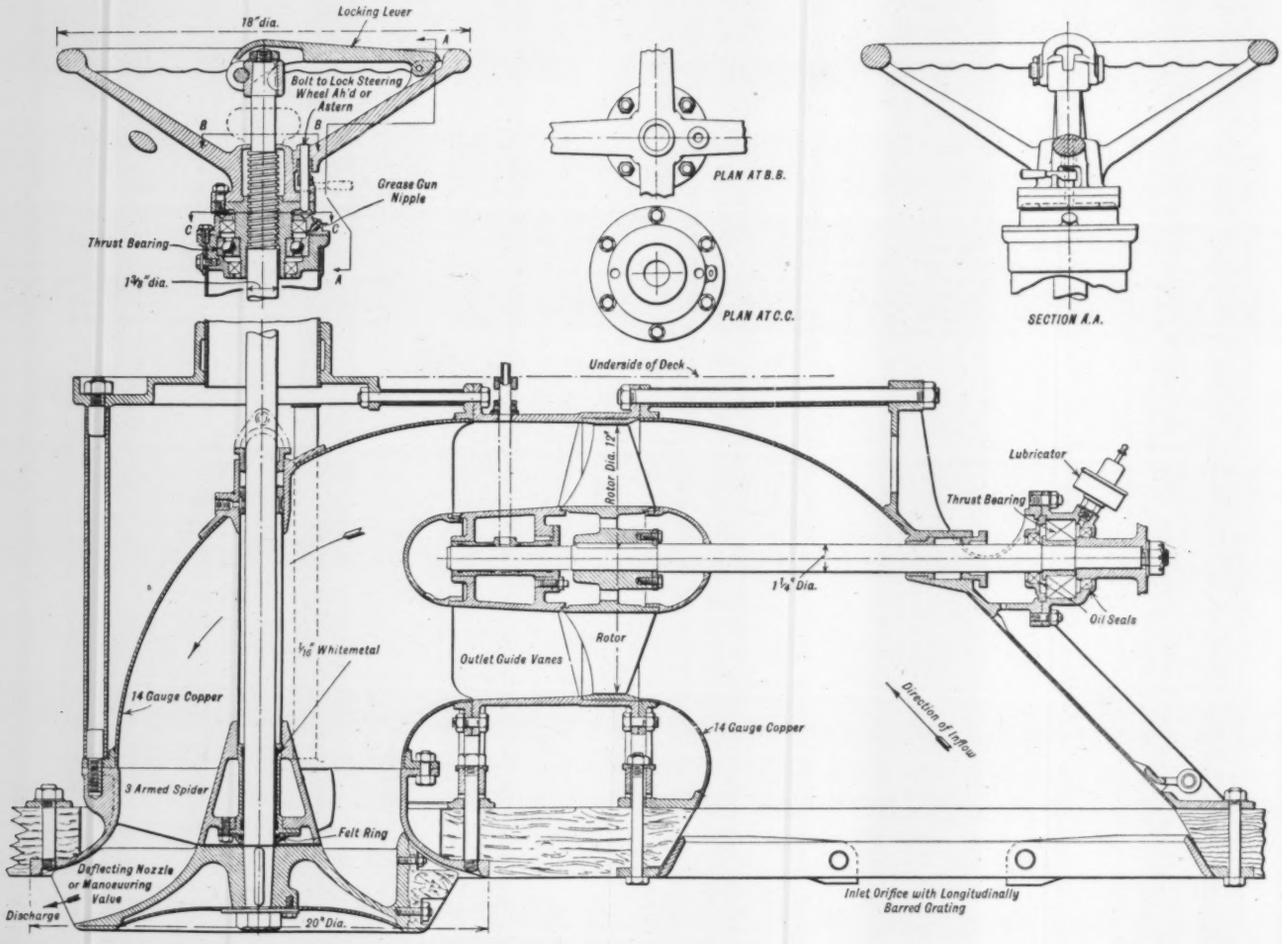


FIG. 1 GILL HYDRAULIC PROPULSION UNIT

combined with the sluicing action of the jets, and the ease with which these can be swung from side to side, enables the boat to refloat herself should she run aground. By turning the jets either directly toward or directly away from each other, the boat can be held stationary, while by turning both jets outboard it becomes possible to hold up the boat against another vessel or a quay without tying up.

With regard to propulsive efficiency, while the efficiency of the Gill pump is considerably higher than that of any screw propeller and the loss in the deflector is extremely low, the pump efficiency and the propulsive efficiency of the jet must both be taken into account when calculating the over-all efficiency of normal propulsion, which brings that efficiency to a lower figure than that for a good screw propeller operating under really favorable conditions for this has only one efficiency figure to be considered.

The reduction in over-all efficiency is, however, offset by the fact that whatever resistance is opposed to the motion of the boat, there can be no churning of the water passing through the pump, which continues to operate at its designed efficiency and to deliver its normal output, with the result that a boat so fitted drives through a head sea and over shoals or obstructions in a manner that is very remarkable.

Hydraulic-Turbine Developments

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROGRESS is now being made toward improved designs and reduced cost of hydraulic turbines, stimulated in some degree by the research in aerodynamics which is being conducted by the airplane industry, says I. A. Winter, senior engineer, U. S. Bureau of Reclamation, in a paper appearing in the November, 1939, Proceedings of the American Society of Civil Engineers. This is one of the papers which were presented at a symposium on hydraulic power-plant design and efficiency, held by the Society in October, 1938. Other authors included L. M. Davis, H. G. Gerdes, W. L. Voorduin, and A. T. Larned. The last named author presented a similar paper before the A.S.M.E. which was published in the August, 1939, issue of MECHANICAL ENGINEERING.

In his paper, which was revised prior to publication in order to bring it up to date, Mr. Winter tells of new and interesting advancements in hydraulic-turbine practice and research, many features of which are still in the proposed or experimental stage. He makes the prediction that, in the future, progress in water-power designing will be parallel to the progress in aeronautical design, inasmuch as specific speeds and velocities now in common use will be increased, resulting in higher efficiency, lower maintenance, and reduced first cost.

According to Mr. Winter, many improved features of turbine design are contributing to better performance of the units and to reduced maintenance cost. Venting the center of the draft tubes of fixed-blade Francis-type and propeller-runner turbines, with free air through the hollow bore in the turbine shaft, similar to that at the power plants at Hoover Dam and Drop No. 4 of the All-American Canal System in California, is effective in eliminating hydraulic shock in the draft tube caused by vortex cavitation. The admission of free or compressed air into the draft tube is effective in obtaining smooth operation of the unit, regardless of the tail-water level. The quantity of air required to quiet the draft tube in this manner is relatively small and has been found to have no adverse effect on the efficiency or horsepower of the turbine at any gate opening.

Water-lubricated bearings of rubber, lignum-vitae, or non-metallic composition are meeting with favor for propeller-type

HARDENING BORES BY ELECTRICAL INDUCTION

(An automobile hub is shown in place in an induction heat-treatment machine, just after the hardening operation has been completed. The head of the machine was lowered into the barrel of the hub, bringing the surface of the bore to a high temperature by means of electrical induction, and then withdrawn as water was forced at high pressure through a quenching fixture to complete the hardening operation. The whole operation was accomplished in a few seconds.)

turbines on both the fixed-blade and the movable-blade types. Provisions for the adjustment of the runner clearances are customary. By using water-lubricated bearings in lieu of oil-lubricated babbitted-type bearings, the inaccessible stuffing box below the bearing is eliminated and the turbine pit may be drained entirely by gravity. Corrosion-resisting steel sleeves are fitted to the shaft opposite the bearing and stuffing box.

Improvements in the type of gate linkage arrangement have been of importance. A design that incorporates a cast-iron brake element in tension, regardless of the direction of operation, as well as gate limit stops, independent of all associated parts, has been furnished for the Drop No. 4 plant and is of a type similar to that used extensively in Europe.

Progress is being made in the elimination of pitting on runners by reducing the overhang of gates over the curved entrance to the throat ring, finishing the entrance and discharge edge of the blades, and introducing improved blade shapes of simple curvature. On several new projects, consideration is being given to welding a $^1/_8$-in. layer of stainless steel on the runner shroud and low-pressure areas of the vanes of a Francis runner in the manufacturer's shop. Under these conditions the steel coating can be applied at less cost than when applied in the field, and the reduced friction losses, obtained by the use of stainless steel with ground surfaces, will increase the power and efficiency of the unit.

Increased attention is being given to the prevention of vibration, noise, and instability of operation. At least eight distinctly different types of trouble from this source have been en-

countered and satisfactory solutions found. This is a broad subject, involving many phases of power-plant design, and offers a fruitful field for further investigation.

One of the outstanding developments in turbines has been the automatic device by which the turbine blades can be moved without hydrostatic pressure from the governor oil system. The blades are designed so that they are pivoted ahead of centers of pressure and are proportioned so that they have an inherent tendency to adjust themselves to the water flow. The adjusting mechanism is concentrated in the runner and turbine pits and is not connected with the governor pressure system. The blades open when the turbine is started to reduce hydraulic thrust, and speed is reduced if the machine should run away at normal head. This unit is a distinct American development.

Laboratory investigations conducted in 1939 by the California Institute of Technology at Pasadena, Calif., under the direction of the United States Bureau of Reclamation in connection with the pumps for the Grand Coulee pumping plant at Coulee Dam, Wash., emphasize the fact that, when operating in reverse as a turbine, a centrifugal pump may be slightly superior in efficiency to a hydraulic turbine designed as such. Such a finding may be quite consistent with the design principles as the friction surfaces in a centrifugal pump are reduced to a minimum. The blades are smaller in number, the direction and changes of flow are less abrupt, and the leakage area of the seal is reduced by placing the seal rings at a smaller diameter than is possible in the conventional turbine design. The significant fact revealed by these tests is that when the pump is operating in reverse the speed and power generation are comparable to that of the pump, thus making an ideal unit for pumped-storage projects. The efficiency of the unit when operating as a turbine or pump under the net effective head is approximately the same.

Temperature of Liquid Steel

ENGINEERING

MEASUREMENT of the temperature of liquid steel by means of a platinum thermocouple and a "quick-immersion" technique, developed by the Physics Department of the National Physical Laboratory (Great Britain) in collaboration with a Sheffield firm, is described in *Engineering* for October 20, 1939.

The arrangement, in its final form for routine use in steel works, incorporates a steel pipe, 10 ft to 12 ft long, clamped to a standard charging fork which can be picked up by the furnace charger and inserted into the furnace. To the insertion end of this pipe is attached at right angles a short length (18 in.) of similar pipe. All these metal parts are encased in a $1^1/_2$-in. layer of lightweight diatomite brick which serves as a refractory, heat-insulating protection. The thermocouple is protected by a sheath of silica wedged by a packing of asbestos wool into an orifice at the projecting end of the 18-in. pipe. A thin sheath of steel over the silica sheath affords further temporary protection, serving to protect the silica from contact with the slag during the actual insertion of the thermocouple into the molten steel.

The procedure for making a measurement of steel temperature consists in inserting the fork horizontally into the furnace so that the silica-sheathed thermocouple is over the center of the bath, and then, by inclining the fork, to dip the sheath until it is fully immersed well below the slag and the surface of the steel. The time of immersion required to obtain a reading depends on the detailed assembly of the thermocouple and its mounting, and upon the response time of the electrical instrument used as a temperature indicator. At most, this period is of the order of 10 to 15 sec, and it can be reduced to as little as 4 sec. During immersion, the thin steel sheath around the silica melts and exposes the silica, so that the thermocouple attains the correct temperature, the latter being evidenced by a steady equilibrium reading on the indicator. On withdrawal, the silica sheath is found to have protected the couple which can be immersed repeatedly before serious contamination affects its accuracy. The silica sheath itself and occasionally the end block of diatomite insulation must be replaced, but this repair can be cheaply effected in only a few minutes, when the apparatus is ready for another immersion.

Laboratory tests with this apparatus, at steel temperatures up to 1690 C, have given results in satisfactory agreement with an optical pyrometer used under black-body conditions. The apparatus is said to be in regular use at one steelworks in the Sheffield district.

Decarburizing Pig Iron

THE IRON AGE

INCREASED activity in the steel industry has made it more and more difficult to obtain scrap, for remelting in steel furnaces, that is sufficiently free from carbon, chromium, nickel, copper, and other unknown impurities which may influence the quality of the final product. A substitute for the steel scrap has been found in recarburized granulated pig iron which is produced without melting by a new process developed by Count Bo Kalling and Ivar Rennerfelt, Stockholm, Sweden. The so-called "RK" process, described in *The Iron Age* for Nov. 2, 1939, differs from previous methods chiefly in the fact that carbon is oxidized by means of gaseous oxygen instead of iron oxides, and that the process is carried on continuously by feeding the material through a rotary furnace while it is being simultaneously mixed. In the following, a short description is given of one of the experimental plants in actual operation.

Fig. 2 shows in principle the granulation plant. The pig iron is poured from a ladle into a small container, provided with a hole of suitable section in the bottom. Through this hole the molten pig iron passes down in a thin jet toward a rotating drum, provided with strips of wood, which shatter

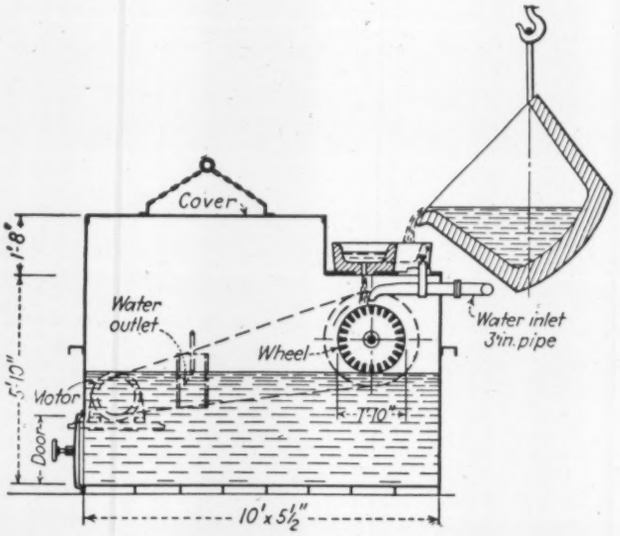


FIG. 2 GRANULATION EQUIPMENT USED FOR PIG IRON

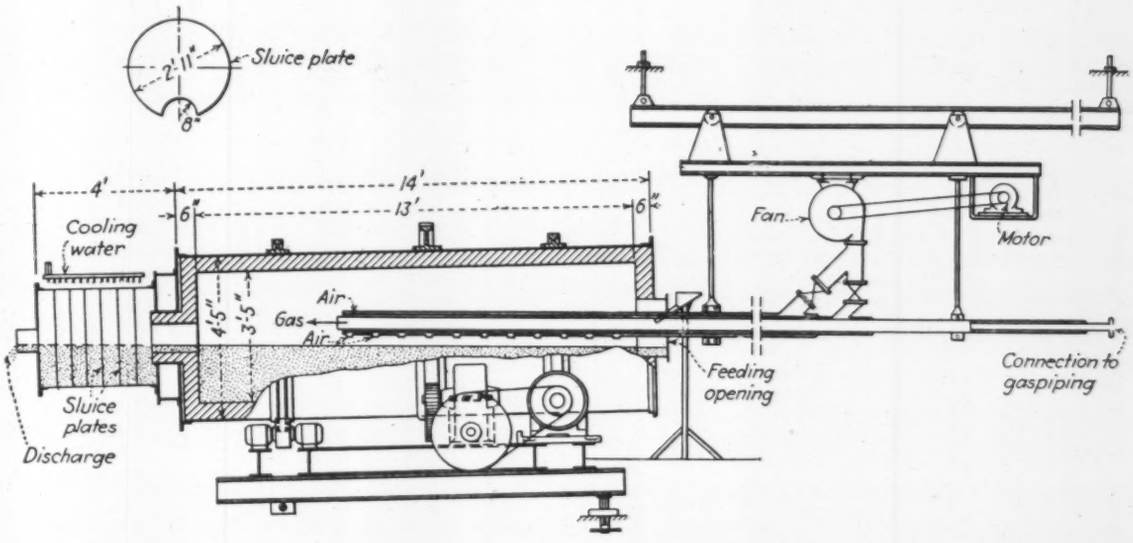


FIG. 3 DECARBURIZATION FURNACE FOR GRANULATED PIG IRON

the jet and throw the pig-iron drops down into the water basin where they are cooled and solidified. About 5 tons of pig iron are granulated at a time, at a rate of about 440 lb per min. The resultant pig iron consists of 4.5 C, 0.50 Si, 1.25 Mn, 0.025 max P, and 0.010 S.

A decarburization furnace with a production of six to ten tons per 24 hours is shown in Fig. 3. The longitudinal inclination of the furnace, which is adjustable, has hitherto been about 3 per cent. The burner consists of three concentric pipes, which, for the parts exposed to high temperature, are made of a heat-resisting iron-chromium-nickel alloy. The two inner pipes are open, whereas the outermost pipe is closed at the end but is furnished with a number of openings along its length. Through the innermost pipe blast-furnace gas is introduced. This gas is partly burned with "primary air," which is introduced through the middle pipe and the amount provided can be regulated. The "secondary air," which is supplied through the nozzles of the outermost pipe at approximately right angles to the charge, brings about the main decarburization here, and at the same time burns the main part of the carbon monoxide of the furnace gas into carbon dioxide before leaving the furnace.

The speed of rotation of the furnace has mostly been about 3 rpm. A temperature of 1922 F has proved to be appropriate in the hottest zone, i.e., at the innermost nozzle for the secondary air. It has proved expedient to regulate the amount of primary air in such a way that the temperature decreases somewhat toward the discharge end. If too much primary air is admitted, there is a risk of oxidation of the iron also in this zone, as here the main part of the carbon has already been eliminated.

During most of the time the output has been only 6 to 7 tons per 24 hr, corresponding to rather more than would fill the furnace once. At this rate of operation there has been no difficulty in keeping the average carbon content of the product under 0.10 per cent, and during certain periods it has been below 0.05 per cent. Operation with more rapid feeding has also been tried. At a feeding rate up to 10 tons per 24 hr, the carbon content could still be kept down to 0.10 per cent. However, when the feeding rate was increased to 13 tons, the carbon values became irregular and rose considerably above 0.10 per cent; this seemed partly to be caused by the air supply being too small.

Regarding the use of the product, the decarburized granulated iron is, in the first place, intended to fill the need of a low-carbon material of known and constant composition and of known origin as a raw material for the manufacture of high-quality steel. It seems to become more and more difficult to obtain scrap that is sufficiently free from the usual alloy constituents, such as chromium, nickel, and copper, besides which there is always the risk of its containing also other unknown impurities which may influence the quality. The product will have a field of use particularly in such processes where usually no appreciable decarburization takes place, such as the electric and crucible steelmaking processes. For the acid processes it is of course necessary that the granulated product be made from a pig iron sufficiently low in sulphur and phosphorus. For the basic processes it will also be possible to use granulated iron made from ordinary coke pig iron for the production of a material with specific requirements.

The possibility of reducing the carbon content of the granulated iron to particularly low values before and during melting seems, besides, to open a not unimportant field of application in the production of alloy steels with low carbon contents.

In cases where the pig iron cannot be directly converted into steel, for instance, if the blast furnace is situated at a long distance from the steel plant and any hot-metal process cannot, consequently, be considered, the advantages of the "R.K." process become more distinct.

Smoke Prevention

SMOKE PREVENTION ASSOCIATION

THE black streamer issuing from smoke stacks is no longer looked upon as a sign of industrial activity, but is regarded as a badge of bad engineering and poor management, states the preface to a "Manual of Ordinances and Requirements" issued recently by the Smoke Prevention Association. Beside containing information on this subject to satisfy the needs of municipalities, architects, engineers, contractors, manufacturers, railroads, and marine interests, the Manual also includes the papers presented at the thirty-third annual convention of the association held in Milwaukee, June 13–16, 1939.

In glancing through these papers and the survey of smoke ordinance regulations in effect throughout the United States and Canada based on questionnaires distributed to approxi-

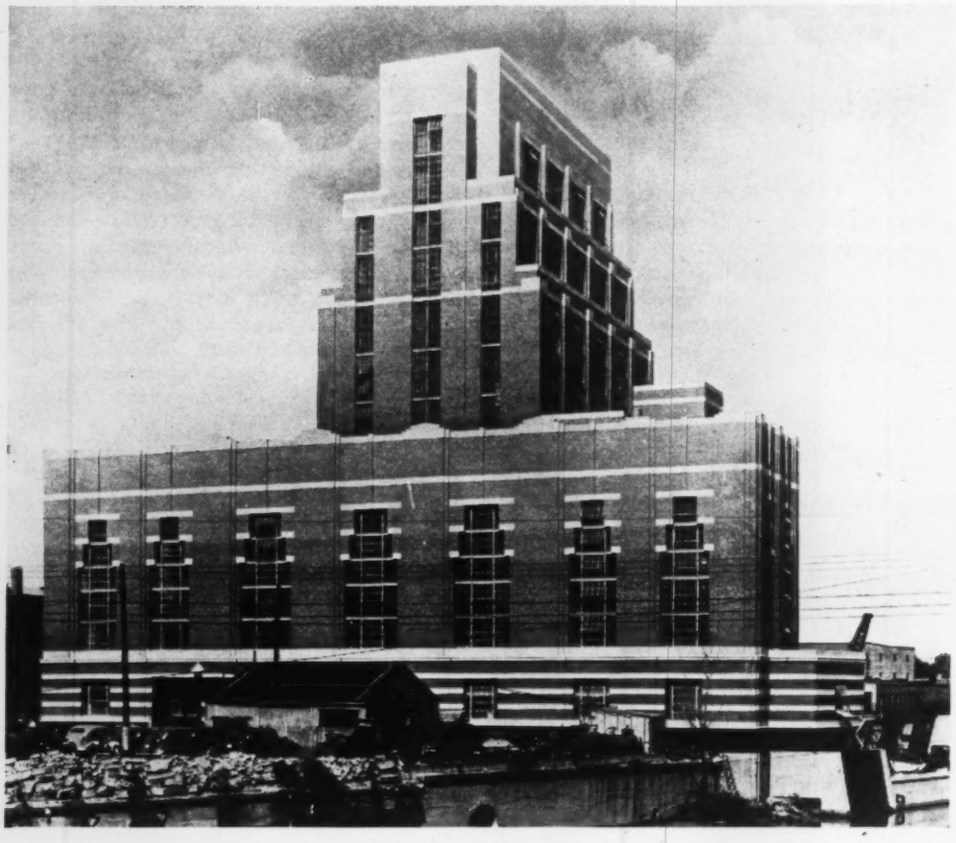
mately 200 cities, one notes that cognizance is being taken not only of the evils of the smoke itself but also of the dust and noxious and poisonous products of combustion. Everyone seems convinced that legislation is a necessary prerequisite to effective smoke prevention but it seems to be agreed that court procedure is a poor method of enforcement and less effective than cooperation with offending owners and operators.

Besides carrying a description of the Ringelmann-chart method of smoke-density measurement, the Manual also gives instructions for analyzing the dust and poisonous-gas contents of smoke. One way of measuring air pollution is by the bag method. This consists in extracting a certain volume of gas from the main gas stream and then passing this gas through one or more bags in which the dust is filtered from the gas. The bags are weighed before and after the test to determine the exact amount of dust in the gas. Where the gas has a high moisture content and precipitation occurs, it is necessary to dry the bags and contents before weighing. While the bag test will not operate at 100 per cent efficiency, it is said to be sufficiently accurate for industrial purposes as practically all of the dust particles are trapped.

To determine the amount and nature of solids and dust that settle out of the air of a city, jars are set up in various districts, exposed for a period of one month, and then taken to the laboratory for analysis. Water, or a mixture of water and antifreeze during winter, is kept in these jars during the period of exposure to catch the solids and thus prevent the wind from siphoning out the deposits. The actual amounts of solids collected in a jar with a $4^3/_4$-in-diameter opening varies between 0.017 and 0.32 oz. The weights of the materials collected are multiplied by the proper factors to convert them to read in tons per square mile per month and per year.

The "lead-peroxide" method, which was devised to measure the effective concentration or "activity" of atmospheric sulphur dioxide, depends on the absorption of sulphur dioxide, by a prepared surface of lead peroxide and estimation of the lead sulphate so formed. Its advantages lie in the independence of the rate of absorption on the humidity of the specimen, on subsidiary processes of oxidation, and in the insolubility of the product. The simplicity of the method seems likely to make it particularly serviceable when it is desired to obtain several simultaneous records of pollution, such as may be needed in determining the effect of a concentrated source on the general level of pollution in the district.

Instructions in the use of the thimble and impinger methods for measuring the amount of dust and the method of analysis for oxides of sulphur are given; and the Manual describes the best ways of burning fuel oil, anthracite, and bituminous coals.



NEW COMBINATION ELECTRIC-GENERATING AND DISTRICT HEATING PLANT OF LANSING, MICHIGAN

(Embracing every successful feature of a decade of high-pressure development, plus many new ones, Ottawa Street Station, Lansing, Mich., is one of the outstanding plants built in this country in years. Surmounting a base of black granite about 6 ft high above the foundation, the exterior is faced with gradually varying shades of brick to its full height of 172 ft. Starting with a region of purplish dark gray just above the black base this gradually merges into a deep red. This in turn becomes first bright red and then orange and finally, as the eye travels upward, yellow. At the top the yellow gives way to a yellow gray. The color scheme is an attempt to symbolize in color the combustion of coal. The stacks of this 35,000-kw station extend only 20 ft above the induced-draft fans and 12 ft above the roof, and are concealed behind the high parapets.)

To A.S.M.E. Members:

THE COUNCIL REPORTS FOR 1939[1]

THE broad objectives of the Society may be considered to be (1) to promote the art and science of mechanical engineering and (2) in cooperation with other engineering societies, to broaden the usefulness of the engineering profession. Each year, the Council which is charged with the management of the affairs of the Society renders an account of its stewardship and gives a measure of the progress made in attaining Society objectives.

The activities of the Society commence with the students in the engineering schools, take up the life of the young graduate, follow him through the attainment of maturity to the realms of specialized experience and broad outlook, and include a venture of the "Old Guard" (members of thirty-five years standing) who have completed this time cycle of activity by interesting themselves in the Students and Junior Members. Geographically, the Society activities cover the country and Canada with 70 Local Sections and 117 Student Branches. In technical range, they deal with the many specialties within the field of mechanical engineering and with the many projects in research, standardization, and codification.

In the paragraphs that follow, the activities of the Society for the year 1938–1939 will be briefly presented under three main headings: (I) Promoting the Art and Science of Mechanical Engineering, (II) Broadening the Profession, and (III) Administrative.

High Lights

1 Four national meetings of the Society were held: at Providence, R. I., New York, N. Y., New Orleans, La., and San Francisco, Calif.

2 At the four national meetings and at four meetings of Professional Divisions, 209 papers and addresses were presented by 252 authors before at least 4835 persons.

3 Local Sections reported 643 meetings and Student Branches held 594 meetings and 10 successful regional conferences.

4 Two hundred and six papers were published, 81 in Transactions and 125 in MECHANICAL ENGINEERING.

5 A comprehensive "Manual on Cutting of Metals" was completed.

6 The policies were re-established of issuing preprints of papers accepted for presentation at Society meetings and of publishing papers in Transactions with discussion after presentation.

7 A factual study of the patent system was inaugurated by the American Engineering Council with the cosponsorship of The Conference Board and the National Association of Manufacturers.

8 The first phase of the accrediting of engineering schools was completed by Engineers' Council for Professional Development.

9 The major litigation of the Parker Case was completed.

10 Membership increased from 14,374 to 14,728.

11 Six thousand student members were enrolled in 117 Student Branches.

12 Expenditures for current activities were kept well within current income.

I—PROMOTING ART AND SCIENCE OF MECHANICAL ENGINEERING

Meetings

For the second year since the adoption of its new policy, the Society has held four national meetings at widely scattered points, giving opportunity to the greatest distribution of the members to participate in these important gatherings. All of the sixteen Professional Divisions cooperated by sponsoring sessions at these meetings. Four Divisions held their own national meetings. In those places where the meetings were held, the Local Sections cooperated wholeheartedly in their conduct.

At Providence in October, 1938, in a city rapidly recovering from the tragedy and destruction of the hurricane on September 21, there were three outstanding addresses. Dr. Henry M. Wriston, president of Brown University, made a valiant defense of machine civilization. The Honorable Louis Johnson, assistant secretary of war, spoke on "Industry Aids the Army." Dr. Harvey N. Davis, president of the Society, dealt with engineering education for management.

At New York in December, 1938, Dr. Harvey N. Davis, retiring president spoke on "Unconscious Tuition." The Towne Lecture was delivered by Mr. Gerard Swope, president of the General Electric Company on "Mechanical Engineering: Materials, Methods, and Men." The Thurston Lecture on the subject of "Physiology for the Engineer" was presented by Dr. H. W. Haggard of Yale University.

At the Spring Meeting in New Orleans, planned jointly with the Louisiana Engineering Society, the outstanding address was that of Major General C. M. Wesson, Chief of Ordnance of the U. S. Army, who spoke on the subject "America Looks to Her Guns."

The San Francisco meeting in July, 1939 was held at the same time that the American Institute of Mining and Metallurgical Engineers were holding a national meeting, and during that week Engineers' Day was celebrated at the San Francisco Exposition, with the program planned by the San Francisco Engineering Council. The principal address at Engineers' Day was by the Honorable Herbert Hoover on "Engineering Contributions to Human Welfare." The A.S.M.E. had the great satisfaction of contributing to the program of Engineers' Day by providing the Calvin W. Rice Lecture, presented by Rodolfo E. Ballester, director of irrigation of Argentina who gave "Some Technical and Economic Aspects of the Argentine." The Society took great pleasure in welcoming this engineering colleague from South America at the San Francisco sessions. Under the direct responsibility of the Society, three outstanding contributions were made. For the first time on a Society program achievements in the development of the combustion gas turbine were described by Dr. Adolphe Meyer, director of the Brown-Boveri Company, Baden, Switzerland, and 1935 Calvin W. Rice Lecturer, at Cincinnati, in an address entitled "The Combustion Gas Turbine."

F. T. Letchfield, member A.S.M.E., consulting engineer for

[1] This report was adopted by the Council on Dec. 4, 1939. Reports of standing and special committees are available on request to the Secretary.

TABLE 1 ANALYSIS OF NATIONAL MEETINGS OF SOCIETY AND FOUR PROFESSIONAL DIVISIONS, 1938-1939

Meeting	Number of papers and addresses	Number of authors	Total registration
Society:			
Fall, Providence, R. I., October, 1938...	35	39	352
Annual, New York, December, 1938.....	72	90	2455
Spring, New Orleans, February, 1939....	25	29	761
Semi-Annual, San Francisco, July, 1939..	27	32	502
Professional Divisions:			
Fuels (with A.I.M.E.), Chicago, October 13-15, 1938.....	13	17	300
Applied Mechanics, New York, June 14-15, 1939.....	14	19	120
Oil and Gas Power, Ann Arbor, Mich., June 19-21, 1939.....	15	18	225
Textiles, Greenville, S. C., April 5, 1939	8	8	120
Total.....	209	252	4835

the Wells-Fargo Bank and Union Trust Company of San Francisco, interested a large audience at the banquet with his address entitled "An Engineer Looks at the Engineers." The banquet was also briefly addressed by Prof. A. G. Christie, president of the Society, on "The Trend of Mechanical Engineering."

The joint meeting with The Institution of Mechanical Engineers, planned for September, 1939, was canceled because of European conditions. This meeting of two groups of mechanical engineers was to form part of a British-American Engineering Congress in which the Institution of Civil Engineers, the American Society of Civil Engineers, and the Engineering Institute of Canada were to join. Members of the societies in the United States had looked forward with keen pleasure to the opportunity for interchanging experience with their colleagues in Great Britain and Canada and suffered real disappointment upon cancellation of the congress.

In addition to the foregoing national meetings of the Society and its Professional Divisions, the seventy Local Sections held 643 meetings.

Student Branches held 594 meetings during the year.

Papers and Publications

During the year the former procedure of providing preprints for papers presented at a meeting of the Society was reinstituted. This enabled the Committee on Publications to return to the former practice of publishing papers in Transactions, after presentation, complete with discussion and author's closure. This change in the publication procedure has been very well received. The increase in the number of national Society meetings from two to four brought an increase in the number of papers and the demand for publication space. The committees concerned with this problem have established a policy looking toward limiting the length of papers to 4000 words whenever practicable and for setting a reasonable limit to the length of discussions. As a result the average length of papers has been reduced five to ten per cent permitting more contributions to appear in the same number of publication pages.

The regular publications are the monthly magazine MECHANICAL ENGINEERING, and a monthly issue of Transactions of which the *Journal of Applied Mechanics* is a part. In these publications 206 papers and addresses were published, 81 in Transactions and the *Journal of Applied Mechanics* and 125 in MECHANICAL ENGINEERING.

The Council adopted a statement of editorial policy and practice for the guidance of the thirty committees responsible for planning of meetings.

The 1940 edition of the Mechanical Catalog and Directory published during the 1938-1939 fiscal year contained an enlarged directory of manufacturers of industrial equipment and material. It now provides a practically complete and authoritative index to the firms serving the mechanical-engineering field.

Research Activity

The reports of the twenty research committees which the Society is sponsoring demonstrate this year how much progress can be made by the cooperative method with the expenditure of a relatively small amount of money. No solicitation for funds was made by these committees during the year but The Engineering Foundation made eight generous grants.

The most important single publication completed during the year is the "Manual on the Cutting of Metals." In addition to this these special research committees produced 25 technical papers which were read before national meetings of the Society. Most of these papers were in the form of reports on work accomplished. Experimental investigations at 19 laboratories have continued throughout the year.

Standardization

The activity of the 301 committees engaged in dimensional standardization under the leadership of the A.S.M.E. Standardization Committee gives evidence of being equal at least to that of last year. Six standards were completed and presented to the American Standards Association for designation as American Standards and 41 committee meetings were held in New York, N. Y., and at other points in the country. Fourteen additional standards, both new and revised, were advanced many steps in the procedure laid down by the American Standards Association.

Power Test Codes

While the revision of only one of the Power Test Codes of the Society, that on Displacement Compressors, Vacuum Pumps, and Blowers, was completed, approved, and published this year together with one section of Instruments and Apparatus (part 13, Speed Measurements), much important progress toward the revision of a number of other codes was made by seven of the code committees. The Committee on Instruments and Apparatus also has advanced the work on five of its studies.

Accident Prevention and Safety

In an unobstrusive way which is nevertheless effective, the Society's Safety Committee has advanced the knowledge and practice of this important concern of industrial management during the last year. As one of the sponsors for the American Standard Safety Code for Compressed Air Machinery and Equipment the Society was able to assist during the year in the completion, final approval, and publication of this important code. Two others, those on Conveyers and Conveying Machinery and Cranes, Derricks, and Hoists are nearing completion.

Boiler Code Committee

In addition to the regular interpretation work, the Boiler Code Committee has issued addenda some of which represent important changes such as a revised table for minimum sizes of boiler outlets for safety valves on fire-tube boilers, extension of the use of fusion welding in power boilers, additional allowable working stresses for ferrous materials, and adoption of four new A.S.T.M. specifications. A new Code for Unfired Pressure Vessels is expected soon.

Library

The 1938 report of the Library Board was distributed to the Local Sections of the Society with the request that some member of each Section be appointed to study the report and make sug-

gestions to the Library Board as to procedures that might be followed to improve and extend the service rendered by the Library. Many comments were received and a comprehensive study has been made by the Library Board on service charges and book loans. Information has been collected from some thirty-five libraries to determine the general practice and experience. The Library Board expresses the hope that as a result of this study broader services will be undertaken without sacrifice of present values.

The number of readers in the Library increased by about 1100 to a total of 32,500 during the last year. Requests for service by mail to the number of 12,000 brought the total number of users to about 44,500. The book collection increased by 5600 volumes to the present total of 147,000 volumes.

Student Branches

During 1938–1939, six thousand student members were enrolled in 117 Student Branches, an increase of about 800. Of 2043 graduates of the classes of 1938 elected to Junior Membership, 850 have validated their transfer by paying dues in full or in part; 117 Student Branches reported a total of 594 meetings during the year. As usual ten excellent Student Branch conferences were held. The Committee on Relations With Colleges, which administers the Student Branches, also administers the Max Toltz Loan Fund. During the year $1040 was loaned to six students. On previous notes due, $1312.66 was repaid on principal and $191.53 on interest.

Honors and Awards

During the year the following honors were awarded:

Honorary Membership to E. Bruce Ball, president of The Institution of Mechanical Engineers of Great Britain, and Henry Hague Vaughan, past-president of The Engineering Institute of Canada
Holley Medal to Francis Hodgkinson
A.S.M.E. Medal to Stephen J. Pigott
Worcester Reed Warner Medal to Lawford H. Fry
Melville Medal to Alphonse I. Lipetz
Junior Award to Arthur C. Stern
Charles T. Main Award to Edward W. Connolly
Student Award, Undergraduate, to Donald C. McSorley
Student Award, Postgraduate, to Marshall C. Long
Pi Tau Sigma Award (Medal) to Wilfred E. Johnson

Juniors

During the last five years, the Society assumed greater responsibilities for growth and development of the young engineering graduates. The principal part of this program has been developed and adminstered by the young graduates themselves through Junior groups, organized in about half of the Local Sections of the Society. In these groups, meetings are held, study units are organized, all in close cooperation with the meetings and activities of the older members, with worthwhile result for the Junior members.

The Committee on Education believes that a distinct need exists particularly among the younger members for a series of coordinated lectures in practical phases of mechanical engineering which are not suited for presentation in engineering schools and colleges.

"Old Guard"

For two years members of the Society who have paid dues for thirty years or more and who call themselves the "Old Guard," have conducted a modest program to interest and stimulate the Student Members of the Society. From special funds collected from among this older group "Old Guard" Prizes have been awarded at the ten Student Conferences held each year, and in 1939 winners of three Student Prizes were brought to New York as the guests of the "Old Guard" to receive their prizes in person. One came from Texas and two from Michigan.

II—BROADENING THE PROFESSION

The Society assumes its share of the burdens of professional problems by cooperation with other engineering societies in joint bodies organized for special purposes. This section of the report will review briefly the work of these joint bodies and of some Society Committees with related functions.

American Engineering Council

The American Engineering Council is a joint organization of the engineering profession "to further the public welfare wherever technical and engineering knowledge and experience are involved and to consider and act upon matters of concern to the engineering and allied technical professions." At the present time American Engineering Council has 54 member bodies—28 local, 18 state, and 8 national—of which The American Society of Mechanical Engineers is one.

The principal effort of American Engineering Council during the last year has been devoted to a factual inquiry into the patent problem. This inquiry is a joint project of American Engineering Council, The Conference Board, and the National Association of Manufacturers. Funds for the work were collected by N.A.M. The study is being carried on by a technical staff assembled by A.E.C. and using its office as headquarters. A staff representative of The Conference Board acts as liaison officer and takes responsibility for the economic aspects of the study. A preliminary report of the findings will be ready for presentation at the annual meeting of A.E.C. to be held in January.

Engineers' Council for Professional Development

The American Society of Mechanical Engineers is one of seven national bodies participating in the work of the Engineers' Council for Professional Development. The program of E.C.P.D. has four principal parts:

1 To provide basis for decision by the young man in the secondary school who is considering whether he will enter engineering.

2 To concern itself with the period of formal engineering education (for the last six years devoted entirely to accrediting engineering schools).

3 To provide guidance for the postcollege training period of the young engineer immediately following graduation.

4 To coordinate the various methods for recognizing attainment in the profession such as registration laws, grades of membership in national engineering societies, and the collegiate degrees granted to engineers.

The principal achievement of E.C.P.D. is the initial accrediting of engineering schools and the preparation of a list of curricula that have met minimum requirements. Attention is now being directed toward maintaining the continued reliability of the list.

The work of E.C.P.D. and its plans for the future are reported on page 909 of the December, 1939, issue of MECHANICAL ENGINEERING in the account of the annual meeting of E.C.P.D.

Registration

Forty-two states and two territories now require registration or licenses. Under the leadership of the Committee on Registration, a Committee representing the Local Sections in New York State has been established to aid the New York State Registration Board in preparing questions for the examinations

required of those who wish to be licensed to practice engineering. Other societies have cooperated in a similar way.

Economic Status and Unionization

The A.S.M.E. Committee on the Economic Status of the Engineer points out that "in the new order of things, mere technical competence and reliability will not assure a living to the young engineer. He needs as much help in understanding the social and industrial environment in which he lives as he needs technical and scientific information. And young engineers who must constantly worry about food, clothing, and shelter for their families cannot be expected to make those contributions to the welfare of the community which are required by the ideals of the profession." The Committee accordingly recommends even more attention than in the past to the economic well-being of the young men. In further pursuance of its program to report special conditions having a bearing on the status of engineers, this Committee secured a paper on the significance of unions in the engineering profession by James H. Herron. The paper was published in the November issue of MECHANICAL ENGINEERING to secure the viewpoints of the members of the Society.

Greater Civic Responsibility

As a means of developing a greater sense of citizenship responsibility among engineers, the A.S.M.E. Committee on Manual of Citizenship recommends that the Council initiate an active program of discussion among students and juniors of the subject of the engineer's civic responsibilities. The Committee promises aid in the selection of discussion leaders and has provided helpful suggestions for conducting the discussion.

III—ADMINISTRATIVE

Parker Case

This year saw the close of the "Parker Case." As the fiscal year opened, an appeal was pending in the Appellate Division from the decision of Mr. Justice Black in the Supreme Court of New York State. Justice Black's decision reached the principal conclusions that the publication of the Engineering Index was not ultra vires or outside the scope of the Society's charter but that nevertheless the inauguration and continuance of the Engineering Index constituted negligence on the part of the Council members and officers of the Society. The Appellate Division of the Supreme Court reversed the decision of Mr. Justice Black that there was negligence on the part of Council members and Society officials and dismissed the complaint upon the merits. Mr. Parker carried the matter to the Court of Appeals, the highest court in the state, which on June 19, 1939, sustained the Appellate Division. Mr. Parker, acting as his own counsel asked the Court of Appeals for the privilege of reargueing his case. On October 10, 1939, his request was refused by the Court of Appeals.

During the year, President Christie sent letters to the members conveying the findings of the Appellate Division and the Court of Appeals. In the November issue of MECHANICAL ENGINEERING on page 847, President Christie also briefly summarized the litigation brought by Mr. Parker since September, 1934, a full five years. Copies of these documents are available to any of the members who wish to have them.

In the judgment of the Supreme Court flowing from the decision of the Appellate Division, the issues of this particular action are decided but in addition there is a provision affecting the interpretation of the charter of the Society which is of such far-reaching importance that it should be called to the attention of the members of the Society. It is quoted herewith:

> "That in promoting the arts and sciences connected with engineering and mechanical construction for scientific purposes, The American Society of Mechanical Engineers may employ any reasonable means to accomplish these ends and it is not restricted to the specific means stated in its charter."

In a previous "visitation" proceeding brought by Mr. Parker and settled in 1935, the Court awarded a judgment to the Society and against Mr. Parker for $1500.00. In the recent action terminating in the Court of Appeals the defendants have judgments against Mr. Parker and his associates for $2829.01 in costs. Since Mr. Parker has not paid any of the sums owing, your Executive Committee instituted proceedings in March in Philadelphia (the address given by Mr. Parker to the Society) to collect the $1500.00 judgment. On September 7, 1939, the Court gave the Society a judgment in Philadelphia for $1783.50, the original $1500.00 with interest. At the close of the fiscal year, Mr. Parker has not paid this judgment.

In addition to the large expenditure of time and energy by the members of the Council, the officers, and staff during this period of litigation which has of necessity distracted attention from the forward-looking activities of the Society, there have been substantial expenditures of money for counsel fees and expenses. The Society retained competent counsel to defend the members of the Council and the officers. The professional fees paid for this period were $32,000, and the costs and expenses incurred were $5116.30. These bills have been paid from the surplus account of the Society which, fortunately, has been able to withstand this very heavy charge without affecting the appropriations for the current activities of the Society.

While the result of the litigations has been to vindicate in every respect the actions of the Society by its Council and officers, nevertheless the opinion of the membership is quite clear that such litigation does the Society harm. The Council is confident that the members of the Society are not in favor of having differences of opinion respecting the policies of the Society fought out in the courts, instead of by the orderly procedure of discussion at its business meeting and by vote of the membership.

Membership

Table 2 shows that the total membership increased during the year from 14,374 to 14,728, an increase of 354. The total number of Junior Members increased by 435 while those in the grade of Member decreased by 94. In order to offset this loss by bringing into the Society men of recognized standing in engineering, a national committee on society development has been formed of representatives of each Local Section. The Standing Committee on Local Sections has been assigned the responsibility to guide this activity and administer the appropriation for this purpose.

In addition to the recommendation of the transfer of 2404 from Student-Member to Junior Member, the Admissions Committee recommended the promotion of 77 and the election of 407 new members in the various grades.

The Admissions Committee has encountered many uncertainties in the interpretation of the Fellow grade and at the close of the year is prepared to request the Council to take the necessary actions to clear the uncertainties in the minds of the members about the meaning of the Fellow grade and in the qualifications that must be met to attain the grade.

The Board of Review considered 462 cases leading to reinstatements, resignations, and similar recommendations.

Delegates Conferences

Representatives of the 70 Local Sections of the Society met in the fall of 1938 in the seven geographical groups throughout the United States and discussed various questions of Society

TABLE 2 CHANGES IN MEMBERSHIP

(September 30, 1938, to September 30, 1939)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1939	Sept. 30, 1938	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net changes
Honorary Members	16	14	1	2	...	...	...	...	1	3	1	+ 2
Fellows	112	96	20	...	...	1	...	...	3	20	4	+ 16
Members	8243	8337	78	160	119	20	121	200	110	357	451	— 94
Associates	225	230	6	5	3	6	6	3	4	14	19	— 5
Junior (20)	921	894	167	32	35	53	30	119	5	234	207	+ 27
Junior (15)	710	604	159	36	13	11	31	60	...	208	102	+106
Junior (10)	4501	4199	3	1109	16	343	96	385	2	1128	826	+302
Total Membership	14728	14374	434	1344	186	434	284	767	125	1964	1610	+354

operation and policy. Representatives of these group conferences met in New York at the time of the 1938 Annual Meeting and formulated recommendations presenting the results of the various conferences. At the meeting of the Council in New Orleans on February 23, 1939, the Council devoted several hours to the consideration of these recommendations and the necessary action thereon. The resulting actions were reported to the officers of the Local Sections and a summary was published in the June, 1939, issue of MECHANICAL ENGINEERING.

Two conferences of representatives of Professional Divisions were held on December 5, 1938, and May 19, 1939. The conference in December met in one session with the Group Delegates Conference of the Local Sections, with the resultant better understanding of the relationships between program-making activities of the Divisions and the Sections.

Society Aims and Organization

In December, 1939, the Council authorized a study of the organization of the Society. The treasurer, Dr. W. D. Ennis, was asked to consider the matter and his reports were considered at two meetings of the Exeuctive Committee during the year. In June, the Executive Committee decided that it would be desirable to reexplore the fundamental purpose of the Society and initiated the preparation of an objective study of Society's aims and activities for publication in MECHANICAL ENGINEERING and discussion by the members. Dr. Ennis' final report, presented at the close of the year, recommended a Committee on Society Office Operation, the appointment of which by the president was authorized by the Executive Committee.

Constitutional Changes

In order to bring the Constitution into accord with present practice and with the Membership Corporation Law of New York, amendments were introduced at the business session of the Society at the San Francisco Meeting, July 10, 1939. These amendments were balloted upon by the membership and the vote will be reported at the Business Session of the Society in Philadelphia on December 4, 1939.

At the meeting of the Council in New York on December 9, 1938, the By-Laws of the Society were changed

1 To eliminate the provision whereby nonmembers of the Society might become members of Local Sections of the Society.

2 To change the time for Council ballot on Honorary Membership from 60 days to 21 days.

Council Actions of Interest

On invitation of the Iowa State College, the Council voted to cooperate in the administration of the newly established Marston Medal.

The preliminary investigation of names suggested for Honorary Membership was assigned to the Committee on Medals. Election of not more than five Honorary Members each year was authorized.

The Council adopted a model form of contract to cover the relationships between the Society, research agencies, and research workers engaged in the research projects carried out under the auspices of the Society.

The Council extended to December 31, 1939, the agreement with Engineering Index, Inc., for the publication and operation of Engineering Index Card Service and Engineering Index Annual Volume.

The Council placed responsibility upon the Secretary for the determination of advance expenditures for publications printed for sale, subject to the review of the Finance Committee.

The Woman's Auxiliary submitted reports advising of the extension of the Woman's Auxiliary by the formation of local sections wherever there are Local Sections of the Society.

Council Meetings and Activities

For the first time in over ten years, the Council has held more than two meetings in one fiscal year. This year in addition to the meetings in connection with the Annual (New York) and Semi-Annual (San Francisco) Meetings, the Council met in New Orleans during the Spring Meeting. In San Francisco, an open meeting was held for members of the Society.

The Executive Committee held 11 meetings.

During the year, the president visited 23 Sections, 18 Student Branches, and two Student Branch Conferences. In addressing the Sections, the president spoke primarily on "Modern Steam Generators." His subject before the Student Branches was usually "Creative Engineering and Getting Your Job." Members of the Council visited 15 Local Sections and 17 Student Branches.

Finances

The complete report of the Finance Committee follows this report of the Council.

Committee Reports

The full reports of the Committees of the Society and of its representatives on joint agencies are embodied in a pamphlet of 52 pages which is available for distribution upon request.

Deaths

In the death of Herman Aaron, counsel for the Society for over thirty years, the Society lost a faithful friend and able counselor.

Among the members who died during the year were Charles M. Schwab, past-president and Honorary Member, Paul Doty, past-president, C. F. Hirshfeld, former vice-president and member of the Council, and Prof. Hugo Diemer, chairman of the Committee on Professional Conduct.

A.S.M.E. FINANCE COMMITTEE REPORT, 1938-1939

BALANCE SHEET—EXHIBIT A

THE balance sheet of September 30, 1939, shows on that date that the Society owed.

(1) One member who holds an unredeemed certificate of indebtedness with interest	$ 510.00
(2) Current bills	34,688.15
(3) Obligations for printing and distributing the 1939 Mechanical Catalog, bills for which have not been submitted	15,600.00
(4) Other obligations for which bills have not been submitted	3,395.82
(5) Special research and other committees which have collected funds for special purposes to be expended as needed	20,327.58
(6) For future services to Members who have prepaid their dues	43,165.73
(7) Advertisers and subscribers to publications who have prepaid	5,334.25
	$123,021.53

To meet these debts the Society had:	
(1) Cash in the bank	$118,508.01
(2) Accounts and notes receivable	32,991.14
(3) Inventories of publications and supplies conservatively valued at	22,754.19
(4) Securities at a quoted market value of	93,732.95
(5) Prepaid expenses of	69.66
	$268,055.95
The difference between the value held by the Society of $268,055.95 and debts of $123,021.53 is the net worth of the Society on September 30, 1939	$145,034.42

The Society had other liabilities:		
(1) Trust funds amounting to		$104,805.84
against which the Society had the following assets:		
(a) Cash	$ 25,827.26	
(b) Notes receivable	5,420.55	
(c) Securities of market value	73,558.03	
	$104,805.84	
(2) Property fund of		$522,721.02
with the following assets to support it:		
(a) Quarter interest in building	$498,448.48	
(b) Office furniture and fixtures (depreciated value)	24,270.54	
(c) Library books	1.00	
(d) Engineering Index—title and good will	1.00	
	522,721.02	
(3) Employees' Retirement Fund of		$ 13,689.98
covered by:		
Cash	$ 3,439.98	
Securities of market value	10,250.00	
	$ 13,689.98	

The total of the Society's Investment and Trust Fund Portfolios is $177,540.98, of which approximately 78% is Lawyers Mortgage Company certificates, the cost of which as shown in last year's report was $296,000.81 and with an appraised value of $147,934.89. Redemptions and sales during the year have reduced the cost value to $257,254.12. The present appraised market value is $138,424.72. A write-up adjustment of $8,666.52 was made. The cash income received during the year from these certificates was $12,753.26. Average yields on these real-estate mortgage certificates were:

	Trust Fund Assets	Society Investments	Aggregate
Based on Cost	4.45	5.00	4.84
Based on Market	8.62	9.68	9.37

INCOME AND EXPENSE—EXHIBIT B

The total income received during the year 1938–1939 was $4,306.19 less than that received during the year 1937–1938. The membership dues received were higher by $3,649.23 but revenues from MECHANICAL ENGINEERING advertising and Mechanical Catalog advertising were considerably lower. Revenue from publication sales was lower by $3,733.75 but the cost of publication sales was also down resulting in an increase of $1,691.68 in the gross income from this source.

SURPLUS—EXHIBIT C

Operating results of the year involve crediting Surplus with $18,266.86, or $5,317.39 more than the previous year, but there are certain nonoperating items which modify the final status of the Surplus account. Chiefly among these nonoperating items were a credit to Surplus of $6,475.29 consisting of a write-up of securities (Society Investments) which was based on a conservative appraisal of the Society's holdings in Mortgage Certificates, the cost of the Parker Case litigation of $37,116.30 which was charged to Surplus and not to the year's Operating Expenses. Surplus after all additions and deductions as shown in exhibit "C" now stands at $145,034.42 or $4,912.74 less than last year.

K. M. IRWIN, *Chairman*
J. J. SWAN, *Vice-Chairman*
J. L. KOPF
K. W. JAPPE
G. L. KNIGHT
ALFRED IDDLES, C. L. BAUSCH } *Council Representatives*
W. D. ENNIS, *Treasurer*

ACCOUNTANTS' CERTIFICATE

TO THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

We have made an examination of the balance sheet of The American Society of Mechanical Engineers as at September 30, 1939, and of the summary of income and expenses and statement of surplus for the year ending that date. In connection therewith, we examined or tested accounting records of the Society and other supporting evidence and obtained information and explanations from an officer and employees of the Society; we also made a general review of the accounting methods and of the income and expense accounts for the year, but we did not make a detailed audit of the transactions.

In accordance with the practice followed by the Society in prior years, no effect has been given in the statements to accrued income on investments.

The membership dues are included in the income account of the current year on the basis of total cash received on account of that year and prior years, and provision has been made for all dues uncollected at September 30, 1939.

In our opinion, based on such examination and with the foregoing explanations, the accompanying balance sheet and related summary of income and expenses and statement of surplus fairly present, in accordance with accepted principles of accounting consistently maintained by The American Society of Mechanical Engineers during the year under review, its position at September 30, 1939, and the result of its operations for the fiscal year ending that date.

New York, N. Y.
October 30, 1939

(Signed) PRICE, WATERHOUSE & Co.

EXHIBIT A

BALANCE SHEET—SEPTEMBER 30, 1939

ASSETS

GENERAL FUND:			
Cash in banks and on hand (including $510.00 reserved for retirement of certificate of indebtedness)			$118,508.01
Accounts receivable:			
Dues—current year	$20,370.34		
Dues—prior years	376.33		
	$20,746.67		
Less—Reserve	20,746.67	—	
Publications and advertising	$35,075.21		
Less—Reserve	3,658.61	$ 31,416.60	
Miscellaneous		1,454.92	32,871.52
Note receivable			119.62
Inventories, at cost or less:			
Publications completed		$ 11,329.47	
Publications in process		11,578.12	
		$ 22,907.59	
Less—Reserve		3,242.71	
		$ 19,664.88	
Supplies		3,089.31	22,754.19
Securities (at approximate quoted market values):			
Real-estate mortgage bonds and certificates		$ 91,732.95	
Railroad bonds		2,000.00	93,732.95
Prepaid insurance			69.66
			$268,055.95
EMPLOYEES' RETIREMENT FUND:			
Cash in banks		$ 3,439.98	
Real-estate mortgage certificate (at approximate quoted market value)		10,250.00	
			13,689.98
TRUST FUNDS:			
Cash in banks		$ 25,827.26	
Notes receivable (Major Toltz Fund)		5,420.55	
Corporate stocks and bonds and real-estate mortgage certificates (at the lower of cost or approximate quoted market values)		73,558.03	
			104,805.84
PROPERTY FUND:			
One-fourth interest in real estate and other assets of United Engineering Trustees, Inc., exclusive of Trust Funds		$498,448.48	
Office furniture and fixtures (depreciated value)		24,270.54	
Library books		1.00	
Engineering Index, Inc.—Title and good will		1.00	522,721.02
			$909,272.79

LIABILITIES

GENERAL FUND:		
Certificate of indebtedness and accrued interest thereon		$ 510.00
Accounts payable		34,688.15
Accrued liabilities:		
Estimated liability relating to Mechanical Catalog for 1939–1940	$ 15,600.00	
Others (estimated)	3,395.82	
		18,995.32
Unexpended balances of Custodian Funds		20,327.58
Deferred credits:		
Dues and initiation fees paid in advance	$ 43,165.73	
Prepaid subscriptions	4,000.00	
Prepaid advertising	1,334.25	
		48,499.98
Surplus (Exhibit C)		145,034.42
		$268,055.95
EMPLOYEES' RETIREMENT FUND		13,689.98
TRUST FUNDS:		
Principal	$ 83,306.44	
Income	21,499.40	
		104,805.84
PROPERTY FUND		522,721.02
		$909,272.79

NOTE: Initiation and promotion fees receivable are not included in the above statement as they are taken up by the Society only as and when collected.

EXHIBIT B

COMPARATIVE SUMMARY OF INCOME AND EXPENSES

For the Two Years Ending September 30, 1939

	Year 1938–1939	Year 1937–1938
INCOME:		
Initiation and promotion fees (to surplus)	$ 7,630.19	$ 8,928.00
Membership dues*	$214,306.03	$210,656.80
Student dues	18,193.00	15,693.50
Interest and discount (net)	9,209.59	8,732.20
MECHANICAL ENGINEERING advertising	71,987.56	75,718.74
Mechanical Catalog advertising	38,481.76	41,453.62
Publication sales	58,052.63	61,786.38
Miscellaneous sales	1,485.25	1,727.61
Contributions—*Journal of Applied Mechanics*	1,200.00	1,775.00
Contributions—Engineering Index, Inc.	518.86	516.52
Registration fees	221.00	409.00
Sale of equipment	770.00	262.50
TOTAL INCOME	$414,425.68	$418,731.87
EXPENSES:		
Expenses under committee supervision	$ 76,378.69	$ 79,585.57
Publication expense (including provision for uncollectible accounts receivable other than dues; 1938–1939, $100.00; 1937–1938, $567.00)	128,739.81	135,234.70
Office expense	191,040.32	190,962.13
TOTAL EXPENSES	$396,158.82	$405,782.40
Net income for the year	$ 18,266.86	$ 12,949.47

* Membership dues have been stated on the basis of total cash received during the year.

EXHIBIT C

STATEMENT OF SURPLUS

Year Ending September 30, 1939

BALANCE, SEPTEMBER 30, 1938		$149,947.16
ADD:		
Initiation and promotion fees collected		7,630.19*
Net income for year (Exhibit B)		18,266.86
Adjustment (net) of carrying value of securities owned to approximate quoted market value at September 30, 1939 (exclusive of adjustment of $3,350.32 in respect of Trust Fund investments credited to Trust Fund Reserve)		6,475.29**
		$182,319.50
DEDUCT:		
Net loss on sale of mortgage investments (based on book value thereof)	$ 168.78	
Legal fees and expenses of Parker suit decided in favor of the Society	37,116.30	
		37,285.08
BALANCE, SEPTEMBER 30, 1939		$145,034.42

* As it is the practice of the Society to take up initiation and promotion fees only as and when collected, the above statement does not include such fees receivable at September 30, 1939.

** After giving effect to this adjustment, the carrying value of these securities is still $94,451.27 below cost. Trust Fund securities are carried at $38,635.96 below cost.

DETAILED COST OF A.S.M.E. ACTIVITIES, 1938–1939

(Approved by Finance Committee, November 17, 1939)

	Expense under committee supervision	Printing and distribution expense	Office expense	Total Cost 1938–1939	Total Cost 1937–1938
Council	$ 4,528.46			$ 4,528.46	$ 4,922.64
Library	9,118.00			9,118.00	9,118.00
American Engineering Council	8,300.00			8,300.00	11,200.00
Engineers' Council for Professional Development	850.00			850.00	
Finance Committee Expense	220.00			220.00	115.14
Awards	549.13		394.70	943.83	776.46
Nominating Committee	476.62			476.62	434.18
Constitution and By-Laws	124.58			124.58	
Local Sections	22,710.95		6,563.55	29,274.50	31,359.46
Meetings and Program	6,550.00		4,895.69	11,445.69	10,554.04
Professional Divisions	2,696.03		4,895.69	7,591.72	6,628.96
Admissions			7,428.81	7,428.81	7,319.46
Employment Service	2,643.72			2,643.72	3,000.00
Student Branches	9,408.38	5,124.41	4,152.17	18,684.96	20,306.21
Technical Committees	1,000.00		19,281.33	20,281.33	20,195.56
MECHANICAL ENGINEERING Text Pages		27,318.97	10,294.63	37,613.60	38,501.00
Transactions and *Journal of Applied Mechanics*	179.05	31,033.58	12,602.64	43,815.27	42,315.28
Membership List		.82		.82	6.54
MECHANICAL ENGINEERING Advertising Pages		16,339.92	21,005.90	37,345.82	38,405.18
Mechanical Catalog		21,426.30	17,144.94	38,571.24	37,453.49
Publications for Sale		27,495.81	8,431.64	35,927.45	42,967.22
Retirement Fund	2,700.00			2,700.00	4,080.00
Parker Case	1,450.27			1,450.27	573.09
Professional Services	1,073.50			1,073.50	1,298.50
Membership Development	1,500.00			1,500.00	
Organization Charts	300.00			300.00	
Secretary's Office			17,208.57	17,208.57	16,810.85
Accounting			13,572.28	13,572.28	12,741.53
General Service			24,925.20	24,925.20	26,544.80
General Office Expense			18,242.58	18,242.58	18,154.81
TOTALS	$76,378.69	$128,739.81	$191,040.32	$396,158.82	$405,782.40

How the A.S.M.E. Spent Its Income in 1938-1939

Dues Income: $214,306.03—$14.55 per Member.

The principal item of income is the dues paid by the members. Juniors pay $10, $15, or $20 depending upon their age; Members pay $20, Fellows, $25, except that those who have been on the rolls of the Society for 35 years or who have reached 70 and have been members 30 years are carried without dues. On September 30 the Society had 14,728 members on its rolls and during the year $214,306.03 was collected in dues. The per-member dues income is therefore $14.55.

Publications: Net Expense $60,074.44—$4.08 per Member.

The publications of the Society are MECHANICAL ENGINEERING, Transactions, including the *Journal of Applied Mechanics*, and the A.S.M.E. Catalog and Directory. Income is obtained from advertising in MECHANICAL ENGINEERING and in the Catalog. Contributions have been received for the *Journal of Applied Mechanics*. An income and expense statement for the publications appears below.

PUBLICATIONS

	Direct expense	Income
MECHANICAL ENGINEERING	$ 74,960.24	$ 71,987.56[a]
Transactions (including *Journal of Applied Mechanics*)	43,815.27	1,200.00
A.S.M.E. Mechanical Catalog	38,571.24	38,481.76
Publications sold	35,927.45	58,052.63
	$193,274.20	$169,721.95
Indirect expense	$ 36,522.19	
	$229,796.39	
Less income	169,721.95	
Net cost of publications	$ 60,074.44	
Total expense of publications per member	$ 15.60	
Publications income per member	11.52	
Net expense per member	$ 4.08	

[a] No allowance is included for what might be considered as A.S.M.E. Member subscriptions to MECHANICAL ENGINEERING or Transactions. The net expense of $4.08 may be regarded as the amount of these subscriptions.

Technical Committee Work: Net Expense $24,657.80—$1.67 per Member.

The Society has nearly two hundred technical committees engaged in the work on research, establishing power test codes, preparing the boiler code, and in preparing standards and safety codes. The work of these committees is supported by direct staff expense which in 1938–1939 was $20,281.33. Adding to it indirect general expense of $4,376.47 gives a total expense of $24,657.80, which on a per-member basis is $1.67. The principal output of the technical committees is publications which are sold to members and to others. This figure of expense should therefore be considered in relation to the publication expense of the Society.

General Society Activities: Net Expense $72,015.83—$4.88 per Member.

The general activities of the Society include the holding of meetings, the operation of Local Sections, Professional Divisions, Student Branches, the administration of the procedure for admitting members to the Society, and the bestowal of awards. The Society receives income from Students for their membership in the Society. The following tabulation shows the net expense for this activity.

GENERAL SOCIETY ACTIVITY EXPENSES

	Direct expense	Income
Society Meetings	$ 11,445.69	$ 221.00
Local Sections	29,274.50	
Professional Divisions	7,591.72	
Student Branches	18,684.96	18,193.00
Admissions	7,428.81	
Awards	943.83	
	$ 75,369.51	$ 18,414.00
Indirect Expense	$ 15,060.32	
	$ 90,429.83	
Less Income	18,414.00	
Net cost of general Society activities	$ 72,015.83	
Total Expense of general Society activities per member	$ 6.14	
Income per member	1.26	
Net Expense per member	$ 4.88	

Joint Activities: Net Expense $30,122.99—$2.05 per Member.

The Society also participates in a number of joint activities such as the Library, American Engineering Council, Engineers' Council for Professional Development, and the joint Employment Service. In addition to the payments to these joint bodies for these purposes a certain amount of general expense is allocated to these activities. The following tabulation gives the total of this expense.

JOINT ACTIVITIES

	Direct expense
Engineers' Council for Professional Development	$ 850.00
Engineering Societies Library	9,118.00
American Engineering Council	8,300.00
Employment Service	2,643.72
	$20,911.72
Indirect Expense	9,211.27
Total cost of joint activities	$30,122.99
Expense per member	$ 2.05

Administrative: Net Expense $9,168.11—$.63 per Member.

In carrying out the Society activities certain administrative services must be provided. These include the expense of the Council, the nominating committee, and the provision for auditing, legal, and other services. Certain general income is received. The following tabulation shows the amount of this expense and income.

General Society Administration

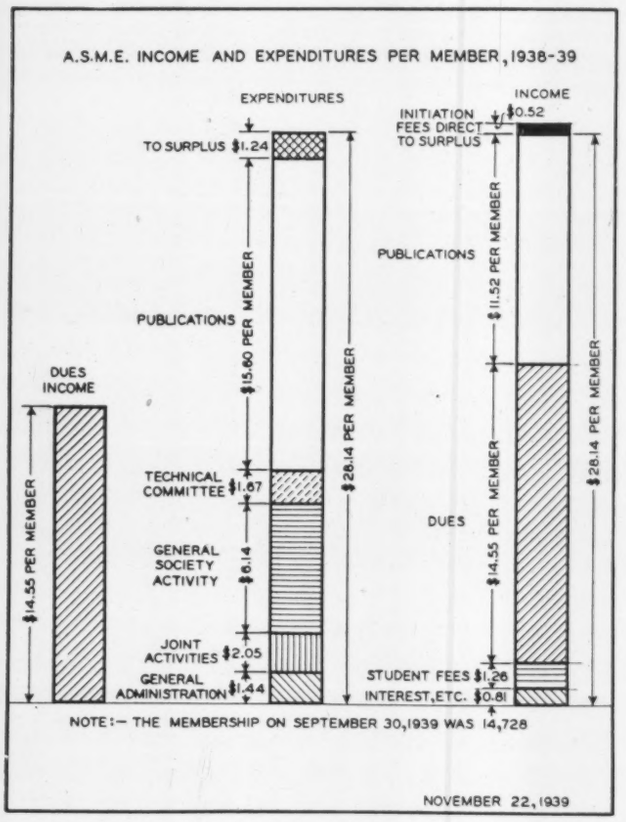
	Direct expense
Council	$ 4,528.46
Nominating Committee	476.62
Retirement Fund	2,700.00
Professional Services	1,073.50
Finance Committee	220.00
Parker Case	1,450.27
Membership Development	1,500.00
Constitution and By-Laws	124.58
Organization Charts	300.00
	$12,373.43
Indirect expense	8,778.38
	$21,151.81
Income from interest and miscellaneous	11,983.70
Net cost of general Society administration	$ 9,168.11
Expense per member	$ 1.44
Income per member	.81
Net expense per member	$ .63

Recapitulation

	Expense	Income
Dues	.....	$214,306.03
Publications	$229,796.39	169,721.95
General Society Activity	90,429.83	18,414.00
Technical Committee Work	24,657.80	.....
General Society Administration	21,151.81	11,983.70
Joint Activity	30,122.99	.....
	$396,158.82	$414,425.68
Addition to surplus from operating income	18,266.86	
	$414,425.68	

Income and Expense per Member

	Expense per member	Income per member	Net expense per member
Dues	....	$14.55	...
Publications	$15.60	11.52	$4.08
Technical Committee	1.67	....	1.67
General Society Activity	6.14	1.26	4.88
Joint Activities	2.05	....	2.05
General Society Administration	1.44	.81	.63
	$26.90	$28.14	
Addition to surplus from operating income	1.24		
	$28.14		



SCENE AT ANNUAL DINNER AND HONORS NIGHT

A.S.M.E. IN PHILADELPHIA

Sixtieth Annual Meeting of the Society Reenacts Familiar Experiences in a New Environment

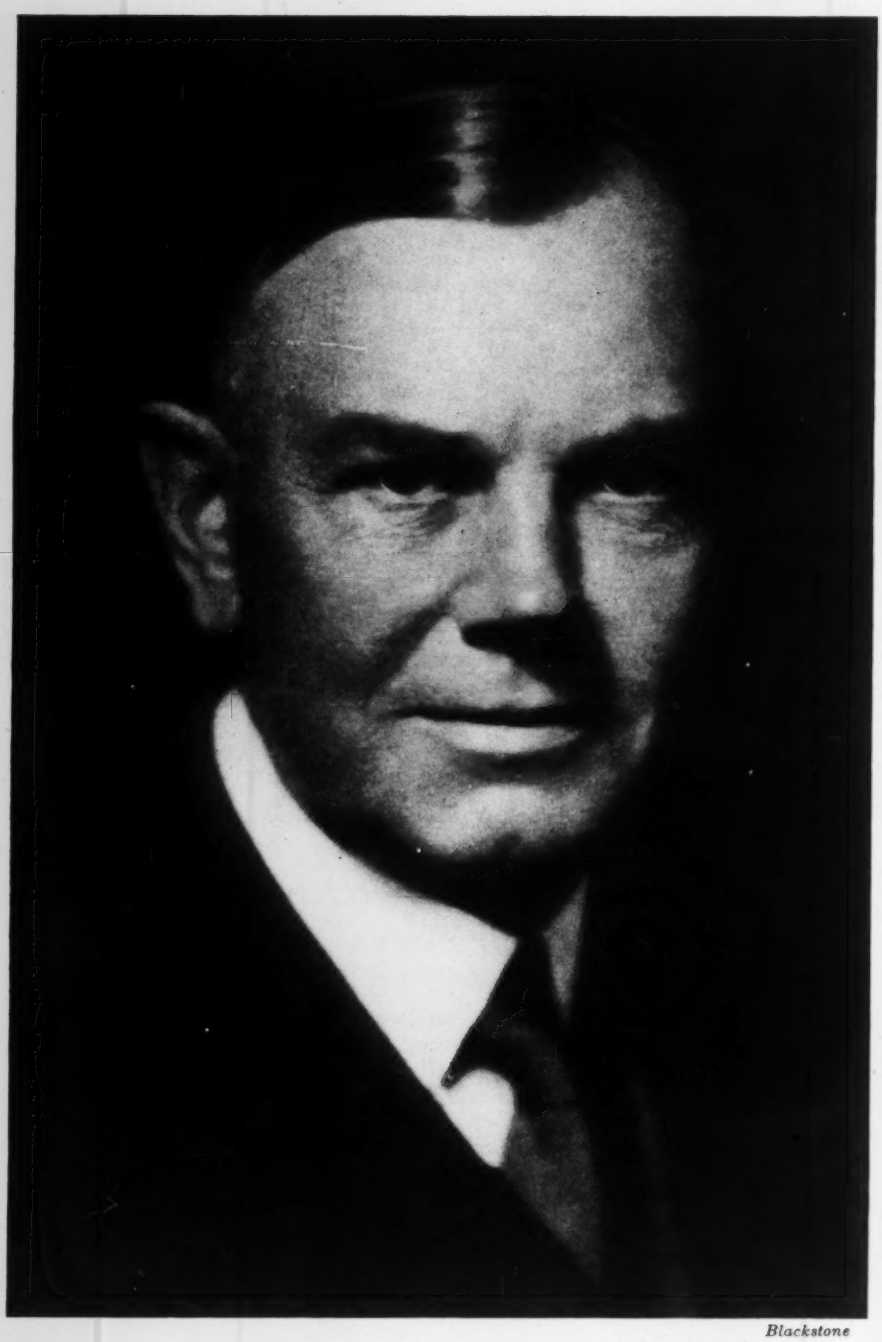
HOLDING its Annual Meeting outside New York City for the first time since 1890, The American Society of Mechanical Engineers met in Philadelphia, at the Bellevue-Stratford Hotel, Dec. 4–8, 1939. This Sixtieth Annual Meeting of the Society, into which Nevin E. Funk, chairman of the Philadelphia General Committee, and his associates poured an abundant measure of thoughtful planning, hard work, and scrupulous supervision, attracted 2200 members and guests from all parts of the country, and afforded an opportunity for the Society to tap new sources of devoted service and engineering interest for this most important of the four national meetings which constitute its customary yearly program. Familiar experiences were reenacted in a new environment.

Unusual circumstances attending the meeting at Philadelphia were responsible not only for the decision to hold the meeting outside New York but the character and nature of the program as well. It will be recalled that the 1939 National Fall Meeting of the Society was to have been held in New York in September and was to have been a joint meeting with The Institution of Mechanical Engineers (Great Britain) in cooperation with other engineering bodies in a British American Engineering Congress. Cancellation of this Congress because of the unsettled conditions in Europe deprived engineers in this country and the A.S.M.E. particularly of the stimulating experiences that would have attended it and came too late to make possible the substitution for it of an all-Society program of the type customarily offered at Fall meetings.

The decision to hold the Sixtieth Annual Meeting of the Society in Philadelphia had been made in view of the proposed British American Engineering Congress at New York. Because the Congress had been built around a group of eight papers, four by British and four by American engineers, all devoted to the general subject of transportation, other papers which normally would have been presented at the 1939 Fall Meeting had been shifted to the Annual Meeting, and hence an unusually large number of sessions and papers enriched the Philadelphia program.

VARIETY OF INTERESTS A FEATURE OF PROGRAM

Growth in the number and diversity of Society interests and the opportunity an Annual Meeting affords of getting together a large number of men interested and active in all phases of its work necessitate an increasing amount of careful planning to avoid conflicts of personal schedules. Even with the most careful planning, however, the average member was confronted with an embarrassment of riches at Philadelphia. Society affairs, such as meetings of the Council and the local-sections group delegates and the business meeting, were held on Sunday and Monday. Technical sessions commenced on Monday evening and continued throughout the mornings and afternoons of Tuesday, Wednesday, and Thursday. Social events, aside from those provided by the program for the women, occupied the evenings, with the "A.S.M.E. Stag" on Tuesday, the Annual Dinner and Honors Night on Wednesday, and college reunions and other dinners on Thursday. Meetings of committees were scheduled throughout the week as opportunity and convenience dictated. For those who could drag themselves away from the headquarters there were numerous



Blackstone

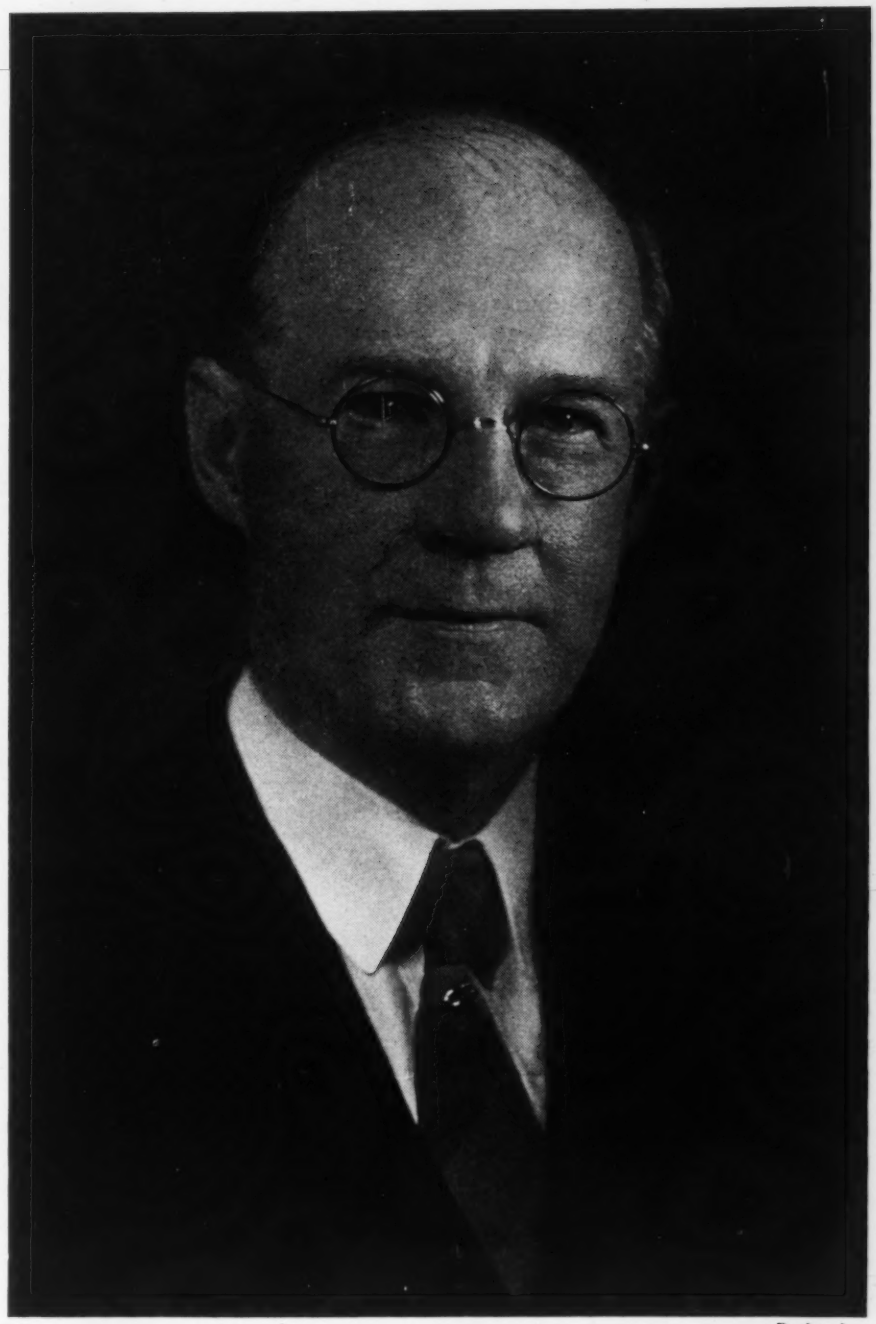
Warren H. McBryde

President of
The American Society
of
Mechanical Engineers
for 1940

instructive plant trips. General and special luncheons afforded some opportunity for relaxation and social intercourse but were also the occasion for addresses and transaction of business.

In the Planet Room, which served for general headquarters and registration purposes, in the lobby, corridors, and bar, wherever there was room to stand or opportunity to sit, highly prized but unscheduled conferences were in continuous but ever-changing session. Conversations were picked up where they had been interrupted a moment, a few hours or days, a year, or possibly several years before, with slight mental adjustments made necessary by changes in girth, graying or thinning hair, or an air of maturity where one remembered gay or solemn boyishness. Here were sounds of familiar voices, and glimpses of familiar faces, new faces and new voices, and the faint shadows of unseen but well-known faces and the echoes of other voices now unheard, in which dozens of Annual Meetings lost their identity and were jumbled into this one, and the Bellevue-Stratford became the Engineering Societies Building in New York. This, one thought, *was* the meeting. Where, but for it, would there be technical sessions, or committees, or reports, or programs; but how, without these more serious matters, would one renew year by year the enriching experiences of the friendships afforded by A.S.M.E. meetings?

Several factors contributed to an atmosphere of encouragement and progress that was evident at the meeting. Fundamentally, of course, the improved condition in which the



Bachrach

Alexander Graham Christie

Retiring President of The American Society of Mechanical Engineers

country finds itself has extended to many of the industries in which engineers are engaged. Opportunity exists for the further development of businesses and products; and acute needs that may arise out of the war, the program of national defense, and in peacetime pursuits afford the incentive for the interchange of ideas and experiences and the planning and prosecution of Society programs in line with industrial and technological development.

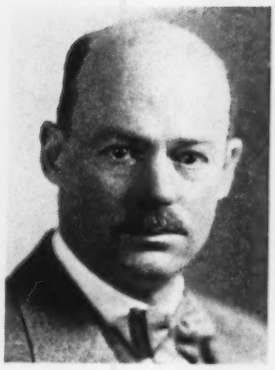
Hand in hand with improved business conditions has come the removal of the retarding influences of the Parker case, now successfully terminated by legal decisions in the Society's favor. Thus, relieved of the incubus that has lain on it for several years, with the demands on time, energy, and money that have seriously handicapped constructive development, the Society finds itself in a position to advance rapidly toward its objectives. Resurgence of enthusiasm in the work of the Society, rededication of individuals and groups to the fulfillment of the pressing needs of technological developments, and constructive planning of many projects typified the discussions and actions of the Council and other Society agencies that met throughout the week. A forward-looking note was sounded at Philadelphia which will be echoed thoughout the months to come. As plans initiated at Philadelphia take shape and develop into programs embracing the entire field of the Society's activities the rising tide of interest in them and of support for the objectives toward which they are directed should engender

Wide World

K. H. CONDIT

Blackstone

FRANCIS HODGKINSON



J. C. HUNSAKER

Phillips

K. M. IRWIN

Vice-Presidents

Mercer Wilson

J. W. ESHELMAN

LINN HELANDER

G. T. SHOEMAKER

Managers

New Members of 1940 A.S.M.E. Council

enthusiastic support and result in an era of positive accomplishment.

THE COUNCIL AND DELEGATES START EARLY

Coming together on Sunday evening for an informal dinner, members of the Council, the delegates of the local-section groups, representatives of Society committees, and officers of the Society were afforded an opportunity to become better acquainted with one another and to discuss Society problems. The more than sixty persons present were unerringly identified and introduced by the Secretary at the request of President Christie who presided. Copies of the annual report of the Council were distributed, and the report itself was summarized by C. E. Davies with comments on it. Elsewhere in this issue this report appears in full, as does also the financial report, once more presented in two forms, both of which were carefully analyzed and interpreted by K. M. Irwin, chairman of the Finance Committee.

In the discussion of the reports that followed, questions relating to Society finances and program were answered by officers of the Society and representatives of the standing committees. Considerable interest centered around membership development. D. B. Prentice, who is chairman of a special committee that is engaged in a campaign to attract to Society membership a large group of mature engineers engaged in fields of activity typical of the Society's interests, announced that more than one thousand names had been referred to the committee and that steps were being taken to induce persons on this list, qualified for membership, to present their application to the Committee on Admissions. The procedure of the Committee on Admissions was described, and the Secretary emphasized how important it was for every member who is named on an application as a reference to provide the committee with full information on the qualifications of the applicant. Mr. Prentice also announced that a new promotional circular entitled "Do *you* belong?" had been prepared for use in membership development.

Considerable discussion also centered around the subject of developing membership among younger men. It was brought out that although a considerable portion of the student members transferred to junior membership on graduation, the total number could be increased. It was evident that in spite of the active development that had been going on in the Society for several years in the junior groups and in other fields of the Society's work whereby the interests and needs of young engineers were receiving attention, greater efforts could and should be put forward. It was felt that expansion and improvement of the work of the divisions, for example, would not only attract more young men to junior membership but would also afford incentives for junior members to seek promotion to higher grades of membership. Student branches, unification of the engineering profession, unionization of engineers, the fellow grade of membership, and stimulation of the work of some of

the less active professional divisions were among the subjects discussed.

Plans for the celebration of the Society's sixtieth anniversary, scheduled for 1940, were reported briefly by D. B. Prentice, speaking for the Committee on Local Sections, and brought out the fact that an index of Society papers available in all its publications and covering the sixty-year period was in process of preparation.

In connection with publications it was reported that efforts were being continued to improve the quality and decrease the length of papers in an attempt to make best use of publication funds. It was announced that the 1940 Membership List would be issued in February, 1940. In response to a criticism of the page size of the Membership List a show of hands indicated an overwhelming preference for the present size ($8^3/_4$ by $11^1/_8$ in.) as compared with the former size which was designed to fit the coat pocket.

Before the discussion closed, President-Elect Warren H. McBryde was introduced. He spoke briefly of his high hopes for the success of the 1940 Annual Meeting and of the opportunity it would afford to demonstrate the appreciation of the Society for the work of the Philadelphia Committee.

THE COUNCIL HOLDS TWO SESSIONS

Every A.S.M.E. Annual Meeting marks the conclusion of one and the beginning of another administrative year. The 1939 Council met at Philadelphia on Monday and again in its final session on Friday, when it adjourned. The 1940 Council convened immediately thereafter under the chairmanship of the new president, Warren H. McBryde. In what follows are summarized the actions of both the 1939 and 1940 Council meetings at Philadelphia that are of general interest.

President Christie called the Council to order at 9:35 a.m. Monday, Dec. 4. Mr. Davies reported the death on Nov. 26, 1939, of Fred. S. Miller, past-president of the Society, and read a brief note of tribute that the Council approved for the record and for transmittal to Major Miller's daughters. The tribute follows:

FRED J. MILLER

In the death of Fred J. Miller, past-president of The American Society of Mechanical Engineers, the Society has lost a man whose active years were rich in services to engineering, to industry, and to the public welfare. His early education, in which contact with men in shops and the pressing problems in the mechanic arts and human relations played the part now largely superseded by college training, taught him to think deeply and wisely on what was going on around him, to be open-minded with respect to new and sometimes revolutionary ideas, and to pass on to others what seemed to him to be worthy of consideration. Communication of his discoveries and opinions to his fellow workers brought him eventually to the editorship of the *American Machinist* and ultimately to positions of large responsibility in the management of industrial enterprises where he put into practice the philosophy of human relations enunciated so wisely and tolerantly in his A.S.M.E. presidential address. Peering behind the veil of tradition and prejudice, he looked for truth and fundamental causes and attempted to formulate rational solutions of ancient problems based on practical consideration and a recognition of the human frailties of men.

He is gratefully remembered for the brief service to the Society as acting secretary during the absence on Society affairs of Calvin W. Rice, who looked to him for advice on administrative problems over a period of many years.

Following presentation of the reports of standing and special committees to the Council, all of which were accepted by formal vote, the Council adopted its 1939 report. The Council and Finance reports will be found elsewhere in this issue. Copies of the reports of standing and special committees may be obtained by applying to the Secretary.

Action of the Executive Committee in allotting $250 for the posthumous presentation of the John Fritz Medal certificate to C. F. Hirshfeld was approved.

Following discussion, a policy was adopted to govern the special handling of the status of members outside the United States during the war.

Amendments to By-Laws B14, Pars. 13, 15, and 16 were approved for first reading. These by-laws relate to financial and auditing procedure.

Rule R14, Par. 2 was amended to read as folows: The Finance Committee shall hold monthly meetings for such business as shall come before it.

The Secretary presented a report on the Parker case and the actions brought against Mr. Parker by the Society for the collection of legal costs allowed by the courts. A statement summarizing the Parker Case appeared in MECHANICAL ENGINEERING, November, 1939, page 847.

Reports of the Senior Councilors on their activities since the Semi-Annual Meeting in July, 1939, led to discussion on several subjects, most important of which were the regional conferences of the local sections and the method of setting up agenda for these conferences.

Speaking for the special Committee on Senior Councilors, W. R. Woolrich presented several recommendations for discussion. In one of these it was proposed to discontinue the Senior Councilors as now designated and to assign to all members of the Council the functions exercised by the present group of seven. Another recommendation related to the procedure of the Nominating Committee and to the methods of conducting group conferences. An important recommendation proposed increasing the number of groups of local sections from seven, as at present, to eight, and suggested a redistribution of local sections within these groups along lines of related regional technical interests and convenience of travel within the group. A fourth recommendation was to the effect that the suggested eight groups should apply to local sections only and not to student branches.

In view of the recommendation made that the number of Local Sections groups be increased from 7 to 8, the Council received proposed changes in By-Laws B7, Pars. 1 and 3, and B11, Par. 11, for action at its next meeting.

On behalf of the Committee on Local Sections, D. B. Prentice requested a transfer of an unexpended balance of funds from delegates mileage to section operation. He reported requests received for the formation of two new local sections; the continued success of junior-group activities; progress in membership development; increase in 1939 of the percentage of student members transferring to junior membership; plans for scheduling Society meetings in the western area; cooperation of several sections with the Engineers' Council for Professional Development; the success of The Rock River Section in advising local school officials on the selection of high-school technical equipment that has resulted in the request by the officials for a permanent advisory relationship; the benefits accruing to the sections from the visits by Secretary Davies and Assistant-Secretary Hartford; and tentative plans for the celebration of the Sixtieth Anniversary of the Society.

Power was voted the President to designate a representative of the Society, to serve without power, but as an observer, at a conference on a schedule of classification and related salaries for engineers.

Led by Harte Cooke, members of the Council discussed the suggestion that a Marine Division be formed.

J. N. Landis presented, with comments, some statistics assembled by a recently appointed special committee on the Society Office.

In conformity with the expressed desire of the Council that

A.S.M.E. GROUP PHOTOGRAPHED ON A VISIT TO THE FRANKLIN INSTITUTE

(*Left to right:* R. E. Flanders, D. S. Kimball, A. G. Christie, H. B. Allen, director of the Institute, D. S. Jacobus, Warren H. McBryde, H. N. Davis, A. A. Potter, J. H. Herron, and Conrad N. Lauer.)

some action be taken to clarify the aims and objectives of the Society for the benefit of members, it was reported that W. F. Durand had been asked to prepare a paper on this subject.

A special committee of the Council appointed to consider the fellow grade of membership reported its recommendations, and after discussion the Council voted that in its opinion the Constitution should be amended so that it would clearly specify the fellow grade as a mark of distinction, that nominees for fellowship should be made by not less than five fellows, and that election should be by unanimous vote of the Council.

S. F. Duncan, speaker, 1939 Group Delegates Conference, presented informally the recommendations of the Conference. The Council received the report with a vote of sincere appreciation.

1940 COUNCIL ORGANIZES

Immediately following the adjournment of the 1939 Council, A. G. Christie introduced the new members of the 1940 Council and presented the gavel to President Warren H. McBryde.

C. E. Davies was reappointed Secretary of the Society and W. D. Ennis was reappointed Treasurer of the Society. The following members were appointed to the Executive Committee: Warren H. McBryde, chairman, J. W. Parker, vice-chairman, K. H. Condit, Clarke Freeman, and W. H. Winterrowd.

The following recommendations of the Advisory Board on Technology were approved:

(1) That the Advisory Board on Technology be continued.

(2) That the personnel of the Board be reconstituted to consist of one member of the Council, who will act as chairman, two members at large, and four other members who shall be the chairmen of the Committees on Meetings and Program, Professional Divisions, Publications, and Research.

(3) That the functions of the Advisory Board on Technology shall be to recommend to the Council ways and means of effecting more consistent and logical coordination and correlation of the technological functions and activities of the Society and also to recommend to the Council procedures whereby the technical quality and scope of the Society's work may be enhanced.

(4) That the name of the Board be changed to "Board on Technology."

President McBryde subsequently appointed the following members on the Board on Technology: Alfred Iddles, chairman, J. C. Hunsaker, R. F. Gagg, L. W. Wallace (Research), Harte Cooke (Professional Divisions), C. B. Peck (Publications), and Erik Oberg (Meetings and Program).

Approval was voted that the Committee on Local Sections select two or three junior members in Milwaukee, Worcester, New York, and Spokane to be invited to attend the Council meetings in their respective cities and participate in the discussion.

DELEGATES AND COMMITTEEMEN LUNCH WITH THE COUNCIL

D. B. Prentice, chairman of the Committee on Local Sections and president, Rose Polytechnic Institute, of Terre Haute, Ind., presided at a luncheon on Tuesday attended by about one hundred members of the Council, delegates to the National Conference, representatives of standing and other Society committees, and others. He introduced a number of distinguished persons sitting with him at the head table and called upon President Christie to speak about the work of the Society.

President Christie confessed to the pleasure he had derived from meeting members of the Society in his many visits to the various local sections and called attention to the importance of these local groups. It had been his observation that there was little discussion from the floor at these local section meetings. In the early days of the Society, he said, much benefit had been derived from mutual exchanges of data and experience. Had the local sections developed this type of meeting, he asked.

Junior members, he said, made up about 40 per cent of the Society's membership, and it was necessary for the Society to maintain the interest of these young men in its work and program. He suggested that it was possible to turn over to these juniors a considerable portion of the work of the sections because the younger men had plenty of time to devote to this task. Moreover, he pointed out, the training was excellent for the juniors and would prepare them for more important tasks as they matured.

Mr. Christie spoke briefly of the value of the work of the standing committees and directed attention to some of the problems of the professional divisions. It was his opinion

that the Society was in need of more members in these special groups in order to offset the tendency toward the formation of small societies.

He expressed regret at the cancellation of the British American Congress and the hope that it might he held some time in the future. In closing he thanked all who had supported him and bespoke for President McBryde a corresponding measure of cooperation.

For the professional divisions L. K. Sillcox thanked all who had cooperated in their work during the year. He spoke of the difficulty of, and necessity for, better coordination between the local sections and the professional divisions and pointed out that a local section was a small society in itself in which were to be found all of the interests of the parent Society.

1939 NATIONAL CONFERENCE OF GROUP DELEGATES

In line with the Society's policy of affording opportunity for members to express their views on its affairs through an organization representative of the 71 local sections scattered throughout the nation, a National Conference of Group Delegates is held in connection with every Annual Meeting. Taking part in this conference are fourteen group delegates and their alternates representing the seven groups into which the sections are divided on a geographical basis for purposes of administration. The local sections that constitute each of these groups elect representatives to attend one of the seven group conferences held several weeks prior to the Annual Meeting. Society problems are discussed at these conferences, and each conference elects a delegate for a term of two years to represent the group at the National Conference of Group Delegates. Because of the method of election and the term of service, every national conference is composed of seven new delegates and seven who attended the conference of the previous year. Each national conference elects officers to serve at next year's conference. Actions of the national conference are reported to the Council and are referred by the Council to the appropriate standing committees. After the standing committee concerned has discussed the action referred to it, it in turn reports its recommendation to the Council, which then makes such disposition of it as seems best. The actions finally taken by the Council are made public in MECHANICAL ENGINEERING. The conferences represent one of the many activities of the Standing Committee on Local Sections.

HIGH LIGHTS OF THE CONFERENCE

The 1939 National Conference of Group Delegates held two sessions at Philadelphia, Monday morning and afternoon. The officers of the conference, elected at last year's meeting, were: Sydney F. Duncan, of Los Angeles, Calif., speaker; Charles A. Hescheles, of Brooklyn, N. Y., vice-speaker; and Robert A. Spence, of Cambridge, Mass., secretary.

Detailed minutes of the actions taken by the Group Delegates during their National Conference, are being prepared and will be distributed at an early date. The following summary was prepared by the speaker, Mr. Duncan, and covers only those actions which seem to have the most bearing on Society affairs and policies.

(1) It is apparent that, by means of the Regional and National Conferences, a growing body of members is being brought to a better and more sympathetic understanding of Society affairs and problems.

(2) The conference considered the importance and necessity of maintaining member interest and, realizing the responsibility of each local section, recommends that the Local Sections Committee study and develop ways and means of combating two influences tending to draw members away from A.S.M.E., namely (*a*) the lower dues and specialized activities of other organizations and engineering clubs and (*b*) the geographical spread of some local sections making frequent meetings difficult.

(3) Believing that many qualified and desirable men are prevented from joining the A.S.M.E. by higher initiation fees for member grades above junior and that the transfer from junior to member grade is unnecessarily impeded by the transfer fee, the conference recommended that all initiation fees be established at $10 and that transfer fees be eliminated.

(4) Voicing the feelings of a considerable portion of the membership, the conference recommended that the fellow grade be made an honor grade, that application for transfer be initiated by sponsors with the permission of the candidate, and that the dues for fellow be reduced to $20. It is understood that the other requirements and qualifications will remain substantially as they are now.

(5) The conference discussed state legislation, both licensing and other legislation, and its relation to engineers. The actions taken reflect the feeling of the membership that local sections through concerted or individual efforts must keep informed on pending laws affecting engineers and that they should be encouraged and aided in this effort by National Headquarters and the standing and special committees concerned.

(6) Realizing that the Society must operate on a budget

1939 A.S.M.E. LOCAL SECTIONS GROUP DELEGATES

(*Sitting, left to right:* C. A. Hescheles, vice-speaker, R. A. Spence, secretary, S. F. Duncan, speaker, R. E. Turner, R. T. Rea. *Standing, left to right:* G. A. Truedsson, N. C. Ebaugh, H. M. Gano, A. R. Acheson, W. D. Turpin, C. J. Freund, Fred H. Dorner, and O. B. Schier, 2nd.)

DAVID T. JAMES

HUBER O. CROFT

JAMES R. BRIGHT

F. V. LARKIN

(At Honors Night Professor Croft presented Mr. James for the Undergraduate Student Award and Professor Larkin presented Mr. Bright for the Charles T. Main Award.)

and keep its expenditures within income, the conference urged that increased funds be made available to local sections' operation, it being the conviction of the conference that the local-section activities are the most important means of developing and maintaining a large and active membership.

(7) Acting in the sincere belief that valuable men are sometimes kept from taking part in conferences and committee work by the out-of-pocket expense incident to traveling on the present travel allowance, the conference recommended that this allowance be increased to train fare plus Pullman fare plus $5 per diem for travel time plus two days at the conference or meeting.

(8) A discussion of publications brought out the opinion that the membership is generally pleased with MECHANICAL ENGINEERING and Transactions. It is a pleasure to report the sentiment that, good as it was, MECHANICAL ENGINEERING has continued to improve during the year. Specific suggestions will appear in the complete minutes.

(9) The conference gave a unanimous vote of confidence to Council for the handling of the Parker case and passed a resolution of appreciation for the continuous and conscientious work of the officers, the Council, and Committee on Local Sections and for the work of all who have contributed to the obvious improvement in the Society during the last year.

Delegates to the 1939 National Conference of Group Delegates were the following:

GROUP I: ROBERT A. SPENCE, Cambridge, Mass. (1 year), Boston Section; GOSTA R. TRUEDSSON, West Hartford, Conn. (2 years), Hartford Section; ARNOLD H. BEEBE,[1] Fairfield, Conn. (alternate), Bridgeport Section.

GROUP II: CHARLES A. HESCHELES, Brooklyn, N. Y. (1 year), Metropolitan Section; O. B. SCHIER, 2nd, New York, N. Y. (2 years), Metropolitan Section.

GROUP III: J. T. REA, Bethlehem, Pa. (1 year), Anthracite-Lehigh Valley Section; ALBERT R. ACHESON, Syracuse, N. Y. (2 years), Syracuse Section; A. L. RUIZ, Schenectady, N. Y. (alternate), Schenectady Section.

GROUP IV: N. C. EBAUGH, Gainesville, Fla. (1 year), Florida Section; A. D. ASBURY,[1] Greenville, S. C. (2 years), Greenville Section; J. E. GETZEN,[1] Birmingham, Ala. (alternate), Birmingham Section.

GROUP V: C. J. FREUND, Detroit, Mich. (1 year), Detroit Section; H. M. GANO, Dayton, Ohio (2 years), Dayton Section. C. T. OERGEL,[1] Erie, Pa. (alternate), Erie Section.

GROUP VI: R. E. TURNER, Chicago, Ill. (1 year), Chicago Section; FRED H. DORNER, Milwaukee, Wis. (2 years), Milwaukee Section; R. A. CROSS,[1] Davenport, Iowa (alternate), Tri-Cities Section.

GROUP VII: S. F. DUNCAN, Los Angeles, Calif. (1 year), Los Angeles Section; W. D. TURPIN, Salt Lake City, Utah (2 years), Utah Section; E. N. BATES,[1] Portland, Ore. (alternate), Oregon Section.

[1] Not present at the meeting.

ANNUAL DINNER IS COMBINED WITH HONORS NIGHT

Probably the largest Annual Banquet ever held by the Society took place on Wednesday evening in the ballroom of the Bellevue-Stratford. Between 1100 and 1200 members and guests taxed the capacity of the ballroom, overflowed into the balcony, and into the adjoining Clover Room. Because the usual program was augmented by combining with it that of Honors Night and the presentation of the certificate of the John Fritz Medal Board of Award, the exercises were unusually long and colorful. To D. S. Walker, chairman, and C. W. E. Clarke, subchairman of the Committee on Arrangements, and to Messrs. K. M. Irwin, W. V. Sauter, R. C. Burton, W. R. Lurtey, Robert Knipe, George Fisher, Charles Hoffner, and S. H. Libby who served with them is due the credit for an unusually successful dinner.

In addition to the customary "speakers' table," at which were seated the toastmaster, Horace P. Liversidge, fellow A.S.M.E., president, Philadelphia Electric Company, President Christie and President-Elect McBryde, and the honored guests of the Society, was an "honors table" for those taking part in the Honors Night exercises.

As toastmaster Mr. Liversidge had a long and varied program

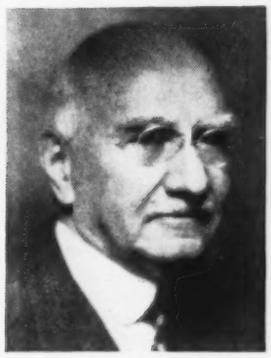
JOHN I. YELLOTT, JR.

H. E. DEGLER

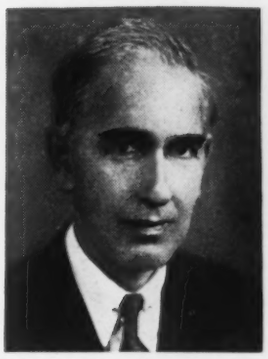
(At Honors Night Professor Degler presented Professor Yellott for the Pi Tau Sigma Medal.)

HARTE COOKE

L. M. GOLDSMITH



DUGALD C. JACKSON



RUPEN EKSERGIAN

(At Honors Night Mr. Cooke presented Mr. Goldsmith for the Melville Medal and Dr. Jackson presented Dr. Eksergian for the Worcester Reed Warner Medal.)

to present. Following the singing of "The Star Spangled Banner," by Miss Eleanor Eberhardt, daughter of one of the "Fifty-Year Members," Mr. Liversidge introduced the distinguished guests, representatives of other engineering societies and related organizations, and President Christie read the list of 17 A.S.M.E. members whose names had been on the Society rolls for fifty years. To mark this long period of membership "Fifty-Year Buttons" were given to all of the 17 men who were present. The complete list of this year's Fifty-Year members follows:

Oscar H. Baldwin, A. L. Burns, Barton Cruikshank, Nelson C. Durand, F. L. Eberhardt, Thomas Hibbard, D. S. Jacobus, Alex Jarecki, J. H. Penruddocke, John Platt, H. G. Reist, Charles W. Scribner, Frank E. Shepard, George R. Simpson, B. F. Sangland, and F. C. Trowbridge.

Professor Christie next called upon the Forty-Fivers, the Forty-Year Members, and the Thirty-Fivers to stand, and also the two members present whose period of membership exceeded fifty years, Charles T. Main and E. N. Trump.

For the conferring of the honors and awards and the honorary memberships, the usual ceremonies of Honors Night, Mr. Liversidge turned the conduct of the exercises of presiding officer over to President Christie. In accordance with custom, Mr. Christie recognized one by one the officially appointed presenters of the recipients of honors, who advanced to the microphone, delivered a brief speech setting forth the recipient's qualifications and personal history and presented him to the president who then conferred the award that had been voted him by the Society's Board of Honors and Awards. The names of medalists and recipients of prizes and awards, and the citation, and the names of the presenters follow:

Undergraduate Student Award to David T. James, Modeltown, N. Y. (Michigan State), presented by Huber O. Croft.

Charles T. Main Award to James R. Bright, Swampscott, Mass. (Lehigh University), presented by F. V. Larkin.

Pi Tau Sigma Medal to John I. Yellott, Jr., Stevens Institute of Technology Faculty, Hoboken, N. J. (Johns Hopkins University, 1931), presented by Howard E. Degler.

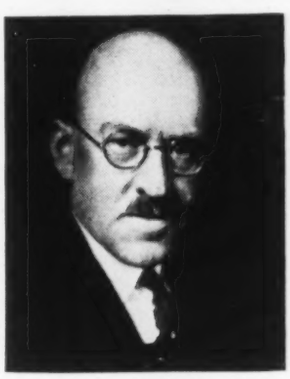
Melville Medal to Lester M. Goldsmith, Atlantic Refining Co., Philadelphia, Pa., presented by Harte Cooke.

Worcester Reed Warner Medal to Rupen Eksergian, Edw. G. Budd Mfg. Co., Philadelphia, Pa., presented by Dugald C. Jackson.

A.S.M.E. Medal to James E. Gleason, Pres., Gleason Works, Rochester, N. Y., presented by Ralph E. Flanders.

Honorary memberships were conferred upon: Henry Hague Vaughan, president, Canadian Foreign Investment Corporation, Montreal, Canada; Dexter Simpson Kimball, dean-emeritus of engineering, Cornell University, Ithaca, N. Y., and past-president, A.S.M.E.; and Charles Thomas Main, consulting engineer, Boston, Mass., and past-president, A.S.M.E. Mr. Vaughan was presented by Roy V. Wright, Dean Kimball by R. L. Sackett, and Mr. Main by Harte Cooke. A fourth honorary membership had been voted to Edwin J. Prindle, but owing to Mr. Prindle's health, it was not conferred on Honors Night. In his response after having received the certificate of honorary membership Mr. Vaughan expressed the appreciation of the Engineering Institute of Canada of the honor bestowed on a Canadian engineer.

JAMES E. GLEASON



RALPH E. FLANDERS

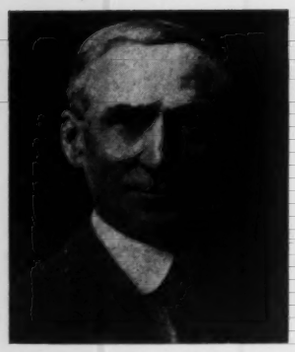
(At Honors Night Mr. Flanders presented Mr. Gleason for the A.S.M.E. Medal.)

JOHN FRITZ MEDAL AWARDED

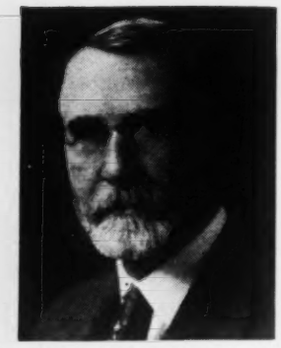
Representing the John Fritz Medal Board of Award, W. L. Batt then took charge of the ceremony for the posthumous award of that medal to C. F. Hirshfeld. The certificate of the award was received by James Hirshfeld, son of the man being honored, who is a junior member of the Society. In presenting Mr. Hirshfeld, James W. Parker, vice-president of the Society and former associate of the deceased medalist, said:

I have the honor of presenting for the award of the John Fritz Medal Certificate, the name of a man who was until recently a distinguished member of this society, the late Dr. Clarence Floyd Hirshfeld.

I am conscious of speaking for many who loved him, for an astonishing number who held him to be a close friend and counselor, when I testify to the worth of this man. He possessed so many homely traits of kindness, and of gentleness and tolerance, that those who were oftenest with him, were apt to allow the broad humanity of the man to obscure for them his intellectural stature as a scientist and engineer.

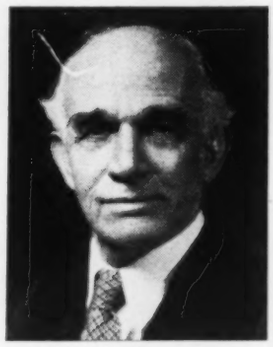


D. S. KIMBALL



CHARLES T. MAIN

H. H. VAUGHAN



E. J. PRINDLE

Made Honorary Members of the A.S.M.E.

Hundreds of his former students at Cornell University remember him best as the witty, scholarly teacher who brought to his teaching an extraordinary capacity for clear exposition of his subject which was a manifestation of the logical, versatile thinker into which he was developing and a marked characteristic of his later years.

When in 1913 he entered the electric-utility field, he was already a man of matured scholarship. He adapted himself readily to the new environment, bearing an active and steadily increasing part in the rapid developments then taking place in power generation and distribution.

His service during the war in the United States Army Ordnance Department caused less an interruption than an intensification of this process of training in the industrial field. Following the return to civil life, he organized the research department of the company with which he had been associated since leaving Cornell, and became more and more active in the electrical industry nationally.

As his engineering experience ripened, his services to the engineering profession increased correspondingly. It is not possible to give here the full account of his many contributions in the form of engineering papers and addresses and of the devoted work as an officer of this society and a member of many of its committees.

In the course of his consulting practice, begun while he was still at Cornell and carried on throughout his professional career, he finally undertook the particular engineering research which led to his greatest single engineering achievement. This was the development of the modernized electric street railway car, which for sheer rational treatment carried out to a successful solution, was a feat rarely surpassed even in this day of applied physical research. It was his most characteristic work and in it he exemplified in a remarkable degree the type of engineering method and thinking which has come to be the ideal of the engineering profession.

These accomplishments measure his professional achievement. His greatest memorial will be the love his friends bore him for his unselfishness and his constant devotion to the cause that was just.

Mr. Chairman, it is my great privilege to present Dr. Clarence Floyd Hirshfeld for the Posthumous Award of the John Fritz Medal Certificate, "for notable leadership through research and development in power generation and electric traction, and for being a great teacher and friend of man, both young and old."

It is a pleasure to introduce to you, Dr. Hirshfeld's younger son, Mr. James Hirshfeld, a Junior Member of the Society and an engineer in his own right, who will receive the certificate in his father's place.

The sincerity and kindly dignity of Mr. Batt in presenting the certificate was, perhaps, the finest tribute to Dr. Hirshfeld that could have been uttered and greatly affected those who had known and admired this great engineer whose name now joins a notable list of men who have received this highest honor that it is in the power of engineers in the United States to bestow.

CHRISTIE AND MCBRYDE SPEAK

The program then returned to the guidance of Mr. Liversidge and time was afforded for a group of songs sung by Miss Eberhardt and the introduction, with appropriate tribute, of Mrs. James Mapes Dodge whose husband had served the Society as president in 1903. The toastmaster also asked a group of 24 student members who were at the dinner as guests of the Old Guard to rise and receive the applause of the guests.

With a precision admirable in an engineer and a college professor, President Christie abstracted his presidential address "Postgraduate Training for Young Engineers" into a presentation that fitted neatly into the twenty minutes he announced it would require. The address is published in full on pages 5–8 of this issue.

At the close of the dinner program the president-elect, Warren H. McBryde, of San Francisco, was introduced and welcomed amid applause. He spoke briefly, pledging himself to preserve and defend the splendid achievements of the Society. He foresaw that in a war-torn world even greater problems might confront engineers. With the assistance of the Council, the committees, sections, and other agencies of the Society, he would hope to recognize these problems and seize upon them so as to cause the engineering profession to rise to greater heights than ever.

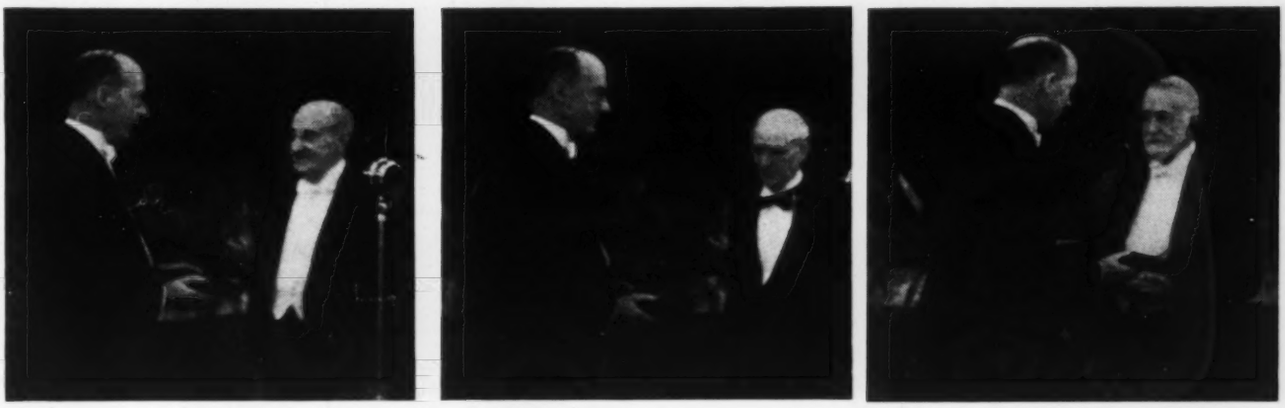
Mr. McBryde's response was followed by an entertaining demonstration "House of Magic," conducted by William A. Gluesing, of the General Electric Co., in which some of the art of léger de main was interspersed among spectacular examples of electrical phenomena, such as the stroboscopic lamp, polarized light, and induced currents.

While the ballroom floor was being cleared for dancing the Presidents' Reception took place in the Clover Room. In the receiving line were Secretary and Mrs. C. E. Davies, President and Mrs. A. G. Christie, and President-Elect and Mrs. Warren H. McBryde.

Following the reception there was dancing in the ballroom until 2 a.m.

PROGRAMS COORDINATED AT PROFESSIONAL DIVISIONS CONFERENCE

In order to coordinate the work of the various professional divisions, discuss organizational and administrative procedure, and plan for future meeting programs, representatives of the divisions met on Thursday afternoon at a conference, which adjourned for dinner and a continuation of the discussion of many common problems. Harte Cooke presided and Mr. McBryde was at the dinner. There were present at the conference the following members of the Committee on Professional Divisions: L. K. Sillcox (chairman), G. B. Karelitz, W. A. Carter (who also represented the Power Division), Harte

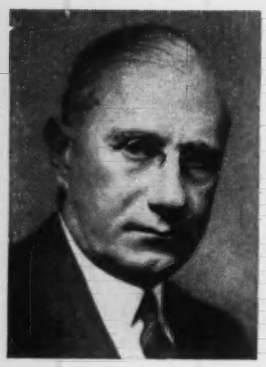


From left to right: President Christie confers Honorary Membership in The American Society of Mechanical Engineers upon Henry Hague Vaughan, president of the Canadian Foreign Investment Corporation, Montreal, Canada, and past-president of the Engineering Institute of Canada; upon Dexter Simpson Kimball, dean-emeritus of engineering, Cornell University and past-president of the A.S.M.E.; and upon Charles Thomas Main, consulting engineer, Boston, Mass., and past-president of the A.S.M.E.

From left to right: Prof. H. O. Croft has just presented David T. James to President Christie for the Undergraduate Student Award; Prof. F. V. Larkin is presenting James R. Bright to President Christie for the Charles T. Main Award; and Prof. H. E. Degler presents Prof. John I. Yellott, Jr., to Professor Christie for the Pi Tau Sigma Medal

From left to right: President Christie confers the Melville Medal upon Lester M. Goldsmith who was presented for the honor by Harte Cooke: Dr. Dugald C. Jackson presents Dr. Rupen Eksergian to President Christie for the Worcester Reed Warner Medal; and Past-President Ralph E. Flanders presents James E. Gleason to President Christie for the A.S.M.E. Medal

Presentation of Honors and Awards at 1939 A.S.M.E. Dinner



H. P. LIVERSIDGE

W. A. GLUESING

(Mr. Liversidge was the toastmaster at the Dinner and Mr. Gluesing presented the "House of Magic.")

Cooke, C. T. Ripley, and Victor Wichum (who also represented the Process Industries Division); and the following representatives of the professional divisions: E. D. Grimison (Heat Transfer Group), L. J. Hooper and F. G. Switzer (Hydraulic), A. R. Mumford (Fuels), G. E. Hagemann and F. J. Shepard, Jr. (Materials Handling), Erik Oberg and Warner Seely (Machine Shop Practice), M. B. Richardson (Railroad), J. D. Robertson (Textile), and F. L. Yerzley (Rubber and Plastics Committee). Ernest Hartford, Mrs. Gene S. Wood, and G. A. Stetson, of the headquarters staff, also attended the conference.

At the conference the representatives discussed the answers that had been received as the result of a questionnaire that had been circulated among the executive committees of all of the divisions. These questions related to what kinds of subject matter were of interest to the several divisions, what procedure was followed in selecting members for the executive committees, success in securing adherence to the rule of receiving papers 90 days in advance of presentation, methods of passing on and reviewing papers, selection of the Society's nominating committee, appointment of junior members to the executive committees of the divisions, and selection of a date for the next conference.

It developed that in general the divisions were interested chiefly in the subjects related to their own field of interest although it was shown that there was considerable overlap of some of these interests and hence opportunity for joint sessions, while some divisions, notably the Railroad Division, had such broad interests that they derived quite as much benefit from the discussions and papers sponsored by other divisions as from those of their own.

Quite generally the executive committees were so conducted that a new member was appointed every year to replace a member whose term expires. A few divisions had so limited a membership that good material for executive-committee membership was scarce, and hence a scheme of rotation was not practicable.

Some divisions found it unwise to adhere to the 90-day rule, although in general the rule was followed.

A common method of reviewing papers and recommending publication was to assign the task to one or two members of the executive committee, although in some cases the paper was reviewed by the entire committee.

In discussion of the method of selecting the Nominating Committee it was pointed out that practically every member of the present committee was actively engaged in the work of the professional divisions, and that although it appeared to be the case that the selection was made by the local sections, in effect every member of a local section was likely to belong also to some professional division.

Most of the divisions recognized the desirability of placing a junior member on their executive committees. Some had done, so, others met so infrequently that opportunity for active participation by the junior member was limited.

Decision was reached to hold the next conference in New York in May.

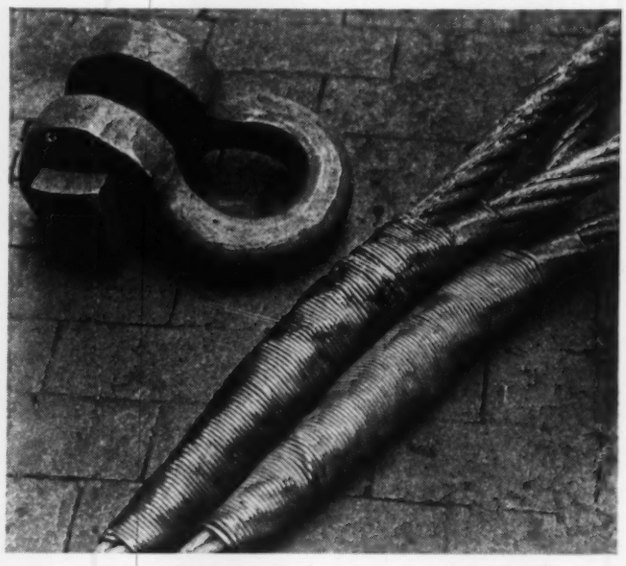
Plans for the coming meetings at Worcester and Milwaukee were reviewed and tentative programs were discussed.

Although competing dinners and other engagements reduced the number able to attend the dinner which followed the conference, the small group that remained, seated at a single table, was able to discuss general policies in an intimate and informal manner. President Warren H. McBryde attended the dinner and took an active part in the discussion, asking many questions and presenting his views.

Among other matters the subject of quality of papers was emphasized by L. K. Sillcox, chairman of the Committee on Professional Divisions. He called for endless diligence in seeking means for insuring the presentation of ever finer papers which would reflect credit on the Society. He made an appeal for the development of new talent within the divisions, for searching out persons in intimate contact with the innovations in their respective fields, and for assisting them in effective presentation. More use could be made of local sections as a medium for presenting division papers, he pointed out.

Mr. Sillcox also called attention to three rules to which the professional divisions had attempted to secure compliance; the 90-day rule, necessary to insure a thorough review of the paper; the rule that seeks to reduce the number of sessions at a meeting and that operates to reduce expense in meetings and publications and to increase the quality of papers because of the higher degree of selection involved; and the rule that attempts to place a limitation on the length of papers with the object of reducing publication costs and securing better papers.

F. L. Yerzley outlined a plan originated by the Rubber and Plastics Committee of the Process Industries Division to sponsor a series of technical papers covering, from the point of view of the designer, the physical properties and design characteristics of the new and important materials that fall within the range of interests of the committee.

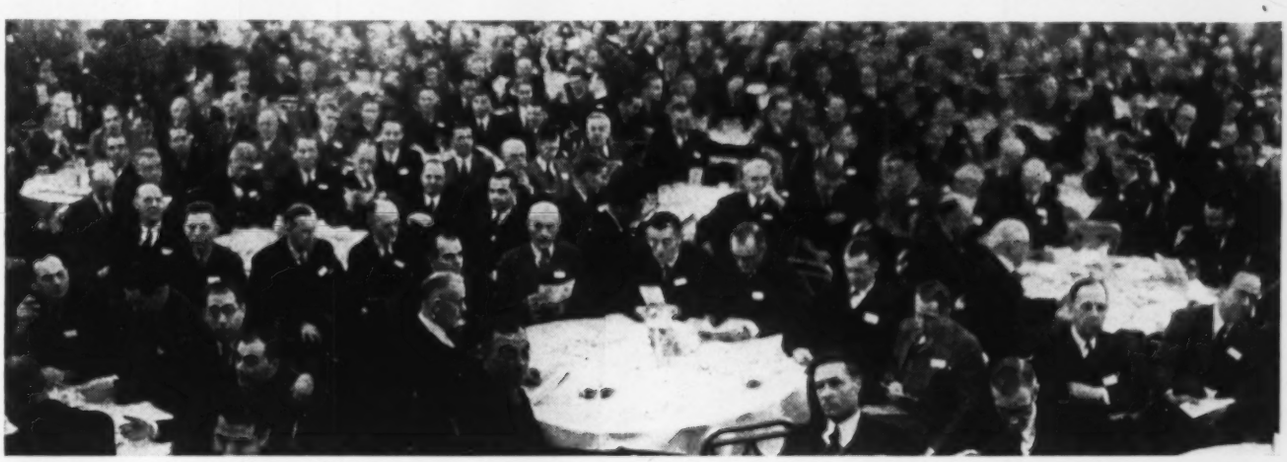


"CLEVIS AND CABLE"

(Photograph taken by John P. Mudd and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Annual Meeting in Philadelphia.)

R. C. H. HECK, H. G. REIST, AND ELMER H. NEFF BALANCING THEIR CUPS AT THE ACQUAINTANCESHIP TEA

W. A. SHOUDY (LEFT) IS REMINDED BY THE EDITOR (RIGHT) HOW P. C. IDELL (CENTER) DEFENDED THE A.S.M.E. AT A BOSTON DINNER



STAGS AT THE SMOKER WITH SONG SHEETS IN THEIR HANDS PAUSE LONG ENOUGH IN THE SINGING LED BY VICTOR SANDERSON TO HAVE THEIR PICTURES TAKEN

C. W. B. CLARKE, WAS CHAIRMAN OF THE DINNER COMMITTEE

MISS ELEANOR EBERHARDT SANG AT THE DINNER

HORACE P. LIVERSIDGE ACTED AS TOASTMASTER AT THE DINNER

MEMORIAL TO CARL G. BARTH

At a specially arranged session held on Monday night, to commemorate the unusual accomplishments of Carl G. Barth, who died on Oct. 28, 1939, President Christie and Morris L. Cooke were the principal speakers.

Mr. Christie, who acted as chairman, in opening the memorial exercises said that industrial production the world over had been revolutionized by the application of the methods of Frederick W. Taylor and his associates. Indeed, he asserted, no greater change than that introduced by these men had taken place since the industrial revolution. New concepts, new methods, new machines, and new ideas came from the men who were associated with Taylor in this work. Outstanding among those associates, said Mr. Christie, was his old friend, Carl G. Barth.

President Christie's first introduction to Carl Barth was through a remark by Mr. Taylor who had characterized Mr. Barth as his "mathematical friend." Mr. Barth had a wonderful grasp of mathematics, Mr. Christie pointed out, and he knew how to use it practically. Many engineers would remember him by the slide rules he devised for shop use.

Mr. Barth was small in stature and slight of build, but what he lacked in size, Mr. Christie attested, he made up in vigor of thought and speech. One never had any doubt about Mr. Barth's opinion. His pointed comments at Society meetings would be recalled by many older members. Some had resented his pointed criticism, but all had respected his views, which were sound and direct. In fact, Mr. Christie asserted, Society meetings would be of greater interest if they were marked by more of this rough-and-tumble type of debate.

Mr. Barth had known the machine shop well and he had loved tools. Moreover, he had had the rare gift of early winning the respect of the men under him.

Mr. Christie said that he had been intimately acquainted with Mr. Barth many years ago when the two had shared a room in a crowded Minneapolis hotel. Mr. Barth had a great love for his family and particularly for his son. He had many lovable qualities and wide interests outside the shop. Mr. Christie concluded by saying that he had always had the greatest admiration for Mr. Barth and had learned of his death with great sorrow. It had been, however, a real satisfaction to take part in the memorial exercises and to pay his respects "to one who was not only a great engineer but a real man."

M. L. COOKE'S TRIBUTE TO CARL G. BARTH

Following Mr. Christie, Morris L. Cooke read a commemorative address which follows:

Those of us who really knew Carl G. Barth realize how he deprecated display and praise. And yet no one would recognize more clearly than he the right of friends and colleagues to give expression both to our sorrow at his passing and pride in his record as a human personality and a great engineer.

His professional career included a number of phases, in each of which he made distinguished contributions to human knowledge—as teacher, machine designer, management engineer, and mathematician.

When he first came to this country, from his native Norway, Carl Barth taught in The Franklin Institute School of this city. Having myself at a later date come under his continued tutelage, I envy the young people who at a time when they were first beginning to use their minds and to be curious about the world around them, had the privilege of being instructed and inspired by one who was never satisfied with the immediate or with surface indications. A later period of teaching in the International Correspondence Schools of Scranton gave him a better opportunity for spying out the world of industry in which he was to play such a conspicuous part.

Following his teaching days came a period when Barth was "tops" in this country on the application of mathematics to machine design. For instance, he actively participated in the design of a type-casting machine striking 160 blows a minute and each such stroke enough to cast a piece of type. The whole contraption is so balanced, and self-contained, that it will do its work standing on four rubber hockey pucks without being fastened in any way to the floor.

It was because of this interest in, and facility for, applying mathematics to involved industrial problems that he met Frederick W. Taylor, the distinguished Father of Scientific Management, and thus had opened up to him the career in industrial organization and management for which he is most widely known.

Taylor sought a way to solve a series of problems bearing on the operation of machine tools—principally lathes—which involved 12 variables. After consulting a number of the leading mathematicians he came to the conclusion that these problems were insoluble by any recognized mathematical procedure. So Barth was assigned the task of determining the feed and speed of a lathe in the face of these 12 variables affecting every such operation. The Barth slide rule, known all over the world, resulted. In intimate association with other discoveries and inventions, such as the Taylor-White tool steel, this mechanism has speeded up many-fold machine tools everywhere. In his attitude toward this grueling assignment we see the essential poet in Barth. In testifying later before a Congressional Committee investigating Scientific Management he expressed, in most beautiful language, the faith that ultimately the machines of the world would be attuned to some vast harmony entirely consistent with the concepts of pure mathematics and with the dross of human error eliminated.

Throughout his life, mathematics—and the purer the better—was the central core about which all his work and frequently his play revolved. Quite early he became a controversialist about mathematical theory. And there were many—both individuals and institutions—against whom he thrust his lance. He roamed so widely over the mathematical field and was interested in so many aspects of the subject—both pure and applied—that he never actually got around to publishing the manuscripts on some of which he worked indefatigably right up to the end.

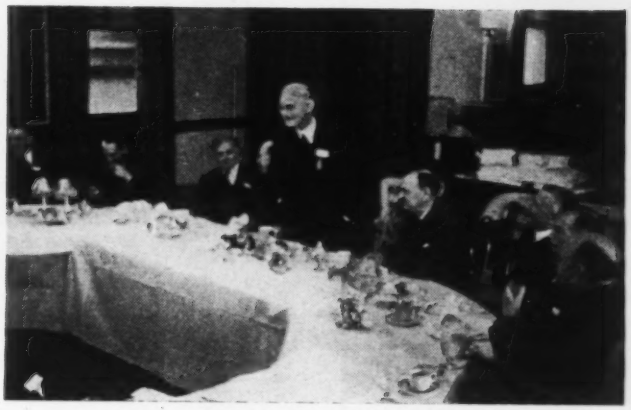
I have another mathematically inclined friend who admitted to me in a moment of candor that he finds no satisfaction in proving anything experimentally. All his deeper elations come from taking a piece of paper and pencil and proving by mathematical computations that this, that, or the other thing has to be so. So it was with Barth. He was never content until he had the *formula* irrefutably establishing the thesis of the moment.

I think it would be relatively easy to prove that, except for his great preceptor Taylor, Barth was the best all-round management engineer of his time. His profound knowledge of mathematics, his skill as a designer, his proficiency in accounting, and above all his persistent anxiety to perfect operating details left an impress on the profession that many another successful practitioner failed to achieve. When Barth finished a piece of management engineering it was usually difficult to improve on it. The word "skimp" was not in his lexicon.

Notwithstanding the fact that Carl Barth was a practical man of affairs, who through long years was handsomely compensated for his services by some of America's outstanding industrialists—William Sellers, Henry R. Towne, Robert Lincoln, and James M. Dodge among others—he had a strong urge toward the abstract in everything he did. His mathematics gave a splendid outlet for this side of his nature.

Through a series of years Barth, Hathaway, and I lectured in the Business School at Harvard on scientific management. At the beginning of each school year we conferred about our respective parts. On one occasion Hathaway and I on calling at the Barth home found the maestro working over a laminated model which looked in some respects like a lady's side saddle. After telling us a bit about its bearing on the work of the moment he explained with great eagerness that he had discovered quite by accident that the equations representing the curves made by intersecting the model at several angles had some curious relation to each other. Hathaway, always a bit of an iconoclast, asked: "Barth, what is the practical application of that?" and Barth, excitedly moving about, replied: "The beauty of it is that it has no practical application."

In his later years after his retirement from the active practice of management engineering he literally played with trial-and-error mathematics—developing the most complicated formulas to describe elusive curves. As indicative of his always intense convictions as to the existence and nature of higher laws he fully believed, and thought he



SECTIONS DELEGATES, MEMBERS OF THE COUNCIL, AND COMMITTEEMEN TURN FROM THE TABLE TO LISTEN TO D. B. PRENTICE, CHAIRMAN OF THE COMMITTEE ON LOCAL SECTIONS, WHO PRESIDED

HEAD OF SECRETARY DAVIES OCCUPIES FOREGROUND OF ONE OF THESE PICTURES OF THE BUSINESS MEETING THAT THE PHOTOGRAPHER GOT IN TWO SHOTS

CROUCHING CAMERAMAN CAUGHT IN AN ATTEMPT TO "SHOOT" D. B. PRENTICE IN ACTION AS TOASTMASTER AT LUNCHEON

had proved, that the most beautiful curves were always represented by simple formulas.

Not being a musician, or possessed of a cultivated appreciation of music, I cannot appraise his love of music except to say that it ever battled with mathematics for his attention. On his long trips away from home on professional work he invariably provided himself with musical records to while away the recreation periods between the most engrossing and harassing engineering assignments. Perhaps on the quiet he played bridge and read detective stories, after the manner of the tired American businessman! But I doubt it. Music and mathematics were his great restorers.

When some men pass on it needs a fervent faith to keep us from saying "It is the end!" Not so with Barth. We have the vivid personal relationships which he nurtured through a long life with rare loyalty and devotion. We have the *giving*—out of the lean purse at times—to causes some of which only brave men support and which do live on in spite of all our narrowness. We have the great contributions he made to science and to the ordering of human labor—especially in machine shops—now enjoying world-wide use and recognition. And above and beyond that the memory of great character—surfaced at times seemingly with steel—but having deep human sympathy and a vaulting outlook as its real substance.

Carl Barth was not very appreciative of the generation in which he lived—even less so than some of the rest of us. He hated sham, easy tasks, and the "go-getter." But being in it he certainly played his part and made real contributions to what he hoped would be a better future for society and for the country of his adoption. We thank him for what he was and is, and as his associates in the world of engineering follow him with a fervent "Farewell—and HAIL!"

At the close of Mr. Cooke's remarks, H. Cadwallader, Jr., of Philadelphia, Pa., member A.S.M.E., spoke extemporaneously of his working as a cub machine designer under Mr. Barth, and of Mr. Barth's contribution to the study of T-slots and bolts for machine tools.

R. P. BROWN ADDRESSES GET-TOGETHER LUNCHEON

With President Christie presiding and many distinguished persons gracing the speakers' table, the Get-Together Luncheon held in the ballroom of the Bellevue-Stratford Hotel on Thursday noon attracted several hundred members of the Society and their guests. The Committee of the Luncheon, of which Lee P. Hynes was chairman, had secured as a speaker a Society member, Richard P. Brown, secretary of the newly formed Department of Commerce of the Commonwealth of Pennsylvania.

The Honorable Arthur H. James, governor of the Commonwealth of Pennsylvania, had been invited to attend the luncheon as guest of honor but was unable to attend. President Christie read the Governor's letter of regret, which contained an expression of his hope that the meeting in Philadelphia would be most successful.

Mr. Brown's address, "Industrial Pennsylvania Stages a Comeback," dealt with the program and activities of the Department of Commerce of the Commonwealth, and will be published in a later issue.

RICHARD P. BROWN

Two objectives were in Mr. Brown's mind in addressing the luncheon; first, he wished to tell about Pennsylvania's comeback, and second, to urge engineers to take a greater interest in politics, "for the sooner we have more engineering in government," he said, "the better it will be for our country."

Concern about the unemployment problem in this country had been heightened by a visit to Europe in 1937, at which time he was forcibly impressed with the fact that there was greater unemployment in the United States than in European countries. He had analyzed the problem on his return and had given it much thought, and had come to the conclusion that it was his duty to help solve it. Hence, when Governor James had recommended legislation creating the new Department of Commerce and had asked him to serve as its head, Mr. Brown had consented to do so.

ALBERT EINSTEIN INSPECTING MODEL OF 200-IN. TELESCOPE AT THE PHILADELPHIA PLANT OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

(Photograph taken by T. B. Hetzel and shown at the Fourth Annual Photographic Exhibit held during the 1939 A.S.M.E. Annual Meeting in Philadelphia.)

Mr. Brown then showed how one of the great problems facing the Commonwealth had been the moving away of industries, and how his first endeavors had been directed toward attempting to restore confidence on the part of Pennsylvania industries, by means of effective help and cooperation with them, and by attempting to interest other industries in locating new plants in Pennsylvania. He gave many examples to demonstrate the success the Department's activities had had and ended by exhorting engineers to contribute their talents toward politics. "Your engineering training is well adapted for service to your country, state, or city," he said. "When we have more engineers like you and more engineering in government, we will have better government."

BUSINESS MEETING

Routine matters occupied the attention of members at the business meeting, called to order by President Christie on Monday afternoon. Secretary Davies reported the result of letter balloting of members on amendments to the Constitution, Article C7, section 3, and Article C9, section 1. The first of these amendments related to the election of directors of the Society and the second to the time and place for the holding of the Annual Meeting. (Both amendments were passed, as was reported in MECHANICAL ENGINEERING, December, 1939, page 944.) Mr. Christie declared the amendments in effect as a result of the ballot.

WHAT IS YOUR NAME, PLEASE, AND WHERE DO YOU LIVE? ACTIVITY AT THE REGISTRATION DESK

ROLLING OF STEEL RESEARCH COMMITTEE WATCHING DR. A. NÁDAI AS HE EMPHASIZES A POINT TO PROF. W. TRINKS

A SERIOUS OCCASION AT ONE OF THE TECHNICAL SESSIONS

MR. GLUESING AND HIS MAGIC

MORRIS L. COOKE DELIVERING CARL G. BARTH MEMORIAL ADDRESS

WHILE THE MEN WERE AT THE SMOKER, THE WOMEN AMUSED THEMSELVES AT A DINNER OF THEIR OWN TO WHICH THE PHOTOGRAPHER WAS ADMITTED

The annual report of the Council and the report of the Finance Committee were summarized by the Secretary and K. M. Irwin, respectively, and approval was voted of these reports and of the transactions of the Society and its Council for the year starting Oct. 1, 1938, to Sept. 30, 1939.

Results of the vote for Society officers (see MECHANICAL ENGINEERING, November, 1939, page 848) were announced by Secretary Davies and President Christie declared these officers elected: Managers, Joseph W. Eshelman, Linn Helander, and Guy T. Shoemaker; vice-presidents, Kenneth H. Condit, Francis Hodgkinson, J. C. Hunsaker, and K. M. Irwin; president, Warren H. McBryde.

1940 NOMINATING COMMITTEE ANNOUNCED

Members of the Nominating Committee for 1940 were elected. The personnel is as follows:

GROUP I: E. R. FISH, *representative*, Boiler Inspection and Insurance Co., Hartford, Conn.; W. F. RYAN, *first alternate*, Stone & Webster Corporation, Boston, Mass.; F. O. HOAGLAND, *second alternate*, West Hartford, Conn.

GROUP II: A. R. MUMFORD, *representative*, Consolidated Edison Co., New York, N. Y.; E. J. BILLINGS, *alternate*, Babcock & Wilcox Co., New York, N. Y.

GROUP III: D. G. WILLIAMS, *representative*, Allentown, Pa.; A. L. KIMBALL, *first alternate*, General Electric Co., Schenectady, N. Y.; F. C. SPENCER, SR., *second alternate*, Westfield, N. J.

GROUP IV: K. P. KAMMER, *representative*, New Orleans Public Service Inc., New Orleans, La.; E. E. WILLIAMS, *first alternate*, Duke Power Co., Charlotte, N. C.; W. R. CHAMBERS, *second alternate*, Tennessee Valley Authority, Knoxville, Tenn.

GROUP V: C. M. GROSS, *representative*, Delco Remy, Anderson, Ind.; WARNER SEELY, *alternate*, Warner & Swasey Co., Cleveland, Ohio.

GROUP VI: O. A. LEUTWEILER, *representative*, University of Illinois, Urbana, Ill.; H. B. BERNARD, *first alternate*, Sinclair-Prairie Oil Co., Tulsa, Okla.; L. P. WEINER, *second alternate*, Hiram Walker & Sons., Inc., Peoria, Ill.

GROUP VII: B. T. MCMINN, *representative*, University of Washington, Seattle, Wash.; RALPH L. DYER, *first alternate*, Seattle, Wash.; E. O. EASTWOOD, *second alternate*, University of Washington, Seattle, Wash.

Prof. O. A. Leutweiler serves the Committee as chairman and A. R. Mumford as secretary.

The remainder of the Business Meeting was taken up by comments by John C. Parker.

TECHNICAL SESSIONS ATTRACT LARGE AUDIENCES

The extent and variety of technical papers presented at the 1939 Annual Meeting may be roughly gaged by the fact that the program included upward of 100 papers, by 123 authors, delivered at 34 sessions sponsored by many divisions and special committees. In addition to the regular sessions, there were many breakfasts, luncheons, and dinners at which papers or discussions were presented and business conducted. Meetings of the technical committees of the Society are reported elsewhere.

Under the plan of operation of the Society, the Committee on Professional Divisions is responsible to the Committee on Meetings and Program for the planning of the technical papers. The various divisions and committees engaged in activities that seek outlet in public discussion of their problems provide the papers and actually sponsor the individual sessions. As is customary for meetings held outside New York, a local committee on technical events is also involved in the success of these sessions. At Philadelphia this committee was headed by J. McCarthy.

Under the present plan of procedure the Committee on Publications makes available in preprint form the papers, received in time for editing and printing, that are approved for publication. Papers assigned for publication in MECHANICAL ENGINEERING are published in advance of the meeting, if possible. Papers assigned to Transactions are published after the meeting. In both cases, discussion resulting from presentation is to be published later. Transaction papers will appear with the discussion.

In view of the fact that most of the papers presented at Philadelphia have been or will be published later, and because time and space are not available even to summarize the discussion, no attempt will be made to give a complete account of the technical sessions.

Under the auspices of the Management Division four sessions were held, the first of which, devoted to the general subject of work standardization, was scheduled for Monday night and was preceded by a dinner. On the following morning the session was devoted to the scientific analysis of managerial problems and included two papers on statistics. Tuesday afternoon's session was devoted to the subject of industrial marketing, while the Wednesday morning topic was administrative organization. Only one of the papers was printed in advance of the meeting, but plans for publication of the others are under consideration.

The Machine Shop Practice Division and its Committee on Machine Design held one session each. In the first session on Monday night the subjects discussed were motion economy in machine design and a new method of machine-tool spindle analysis. At the session on machine design the papers related to design factors controlling the dynamic performance of instruments and quick-acting release latches.

Considerable publicity resulted from the presentation on Monday night of the progress report of the Aeronautic Division. Questions relating to airplane pickup, heating and ventilation of aircraft, and the North Beach Airport, New York, were also discussed.

The Applied Mechanics Division sponsored three sessions on the subjects of elasticity, photoelasticity, and dynamics, at which 13 papers were presented.

Three sessions were under the auspices of the Fuels Division. At one of these sessions there was a symposium devoted to domestic fuels, another provided a paper on the comparative value of fuels and one on the purchasing of fuel, while at the third session filters and flue dust were discussed.

One of the most comprehensive series of papers delivered at the Philadelphia meeting was devoted to prime-mover and system regulation. The three sessions comprising the series were jointly sponsored by the Hydraulic and Power divisions. At a session so popular that hundreds had to be turned away, the Power Division offered a panel of four papers on experiences in topping plants. The Power Division also staged a session of three papers on turbine-blading problems and cooperated with the Railroad Division in another devoted to steam generation. Jointly with the Applied Mechanics Division the Power Division sponsored a paper on piping design.

In addition to its joint session with the Power Division the Railroad Division put on another session at which car engineering, whip stress in locomotive main rods, and the division's annual progress report were featured.

The Textile Division staged two technical sessions and a luncheon at which spun rayon was a popular subject. Air conditioning and paper testing were discussed at a session of the Graphic Arts Division, and the production of strip metal at high melting points directly from molten metal and designs considerations of forged-steel rolls were the topics at the Iron and Steel Division's session.

AN INTERLUDE IN THE COUNCIL MEETING ON MONDAY MORNING

THE PRESIDENT AND THE SECRETARY

5:30 P.M. THURSDAY AT THE END OF FOUR DAYS AND NIGHTS

8 P.M. SUNDAY AT THE BEGINNING OF THE MEETING THE COUNCIL DINES WITH DELEGATES OF THE LOCAL SECTIONS AND COMMITTEEMEN

SOME OF THE PROFESSIONAL DIVISIONS REPRESENTATIVES AT THE PROFESSIONAL DIVISIONS CONFERENCE

ENGINEERS MUST EAT, SMOKE, TALK, AND LISTEN TO SPEECHES MADE BY OTHERS

The Materials Handling Division put on two papers and the Heat Transfer Group four. A group of three papers relating to apprenticeship was featured at a session sponsored by the Committee on Education and Training for the Industries. On the subject of lubrication there were two sessions under the auspices of the Research Committee on Lubrication. The Research Committee on Mechanical Springs sponsored one session with four papers, and the Committee on Industrial Instruments and Regulators, of the Process Industries Division, presented two papers. Another committee of this division, the Rubber and Plastics Committee, sponsored three papers. At a session on thermodynamics, jointly sponsored by the Applied Mechanics Division and the Research Committee on Critical Pressure Steam Boilers, two papers were presented.

TECHNICAL COMMITTEE MEETINGS

The technical sessions were paralleled this year by a group of 43 technical-committee meetings. These meetings extended from early Monday morning to after lunch on Friday. They were divided among the several groups as follows: Research 10, Standards 22, Power Test Codes 11. The total attendance at these meetings was 760.

THE RESEARCH GROUP

As is its custom the A.S.M.E. Research Committee opened the week of meetings with its dinner meeting held on Monday evening. The officers of the 19 special and joint research committees and the members of the A.S.M.E. Council had been invited to attend this general dinner meeting and 26 sat down at 6:15. When the plates had been cleared away Chairman N. E. Funk presided and introduced the other members of the Research Committee. All four were present—Messrs. L. W. Wallace, E. G. Bailey, W. Trinks, and M. D. Hersey. He next introduced J. H. Walker, the newly appointed member of the committee. The chairman then greeted the four advisory members of the main committee, W. H. Fulweiler, Albert Kingsbury, A. A. Potter, and A. E. White; and the following members of Council, Harte Cooke, Clarke Freeman, Linn Helander, Francis Hodgkinson, J. C. Hunsaker, Alfred Iddles, K. M. Irwin, and F. C. Spencer, chairman of the Committee on Admissions.

The other guests present were then requested to introduce themselves and to make brief reports on the progress made by their special research committees during the year just closed. Eleven committees were heard from in this way and their reports were very satisfactory. At the close of this round robin the Research Committee went into executive session and the others present withdrew to attend the technical sessions which were scheduled for that evening.

The first item of importance on the agenda was the election of the chairman for the coming year. Chairman Funk's term of service on the committee is completed this year and Mr. Wallace is next in seniority so the committee elected him chairman.

The secretary reported the completion and publication during the year of the "Manual on Cutting of Metals," a study of the cutting action of single-point cutting tools used in turning in the lathe or similar machines developed by the Special Research Committee on Metal Cutting Data. This manual was published in September, 1939.

Nine special and joint research-committee meetings were held during the five days of Annual Meeting week. They were all well attended and in each case good progress was recorded.

The Special Research Committee on Lubrication, G. B. Karelitz, chairman, sponsored two technical sessions on Wednesday morning and afternoon, Dr. A. E. Flowers presided at the first and M. D. Hersey at the second. The four papers presented at these two sessions were: "The Influence of Crystal Size on the Wear Properties of a High-Lead Bearing Metal," by J. R. Connelly; "Temperature Distribution and Forces in a Conventional Railway Journal Box," by E. S. Pearce; "Properties and Performance of Plastic Bearing Materials," by L. M. Tichvinsky, and "Boundary Film Investigations," by S. J. Needs.

On Thursday morning the Special Research Committee on Mechanical Springs, J. R. Townsend, chairman, sponsored a session. C. T. Edgerton, secretary of the special research committee presided and J. W. Rockefeller, another member of the committee, served as recorder. At this session the reading of two papers, one on "Calculation of the Elastic Curve of a Helical Compression Spring," by H. C. Keysor, and the other on "Helix Warping in Helical Compression Springs," by D. H. Pletta and F. J. Maher, was followed by the reading of two reports, one by C. T. Edgerton on "Fatigue Tests of Helical Compression Springs at Wright Field" and the other a "Progress Report on Book on Strength of Metals," by D. J. McAdam, Jr., of the National Bureau of Standards.

A fourth session was sponsored jointly by the Applied Mechanics Division and the Special Research Committee on Critical Pressure Steam Boilers. Prof. R. C. H. Heck presided at this session.

The annual meeting and conference of the Special Research Committee on Condenser Tubes was held on Wednesday. Chairman A. E. White presided at the committee meeting and Vice-Chairman D. C. Weeks presided at the conference. Forty attended the luncheon and conference which began at 12:30 and continued until 4:00 in the afternoon.

The meeting of the Joint Research Committee on Boiler Feedwater Studies Executive Committee, C. H. Fellows, chairman, held on Wednesday afternoon was given over to business. Ten were present. The subcommittee on effect of solution composition on the cracking of boiler metals, J. H. Walker, chairman, met on Thursday afternoon and discussed the details of its research program.

Meetings at which the business was principally a routine character were held during the week also by (1) Subcommittee on Patent Literature of the Joint Research Committee on Boiler Feedwater Studies, S. T. Powell, chairman, (2) Rolling of Steel, W. Trinks, temporary chairman, (3) Cutting of Metals, M. F. Judkins, chairman, (4) Metal Cutting Fluids, O. W. Boston, chairman, (5) Fluid Meters, R. J. S. Pigott, chairman, and (6) Mechanical Springs, J. R. Townsend, chairman.

THE STANDARDS GROUP RECORDS PROGRESS

The standards group of committees opened its series of meetings on Tuesday morning with meetings of three technical committees of the Sectional Committee on Small Tools and Machine Tool Elements (B5), W. C. Mueller, chairman. These committees were Tool Posts and Shanks, No. 2, O. W. Boston, chairman, Forming Tools and Holders, No. 10, W. C. Mueller, chairman, and Nomenclature of Small Tools, No. 17, O. W. Boston, chairman. Sectional Committee B5 held its annual meeting on the afternoon of the same day. W. C. Mueller presided, J. A. Anglada served as secretary, and nineteen were present.

On Tuesday afternoon the new Joint Committee on Threaded Cast Iron Pipe held its first meeting. Eight of its twelve members were present and good progress was made toward defining American practice for threaded cast-iron pipe for vent, waste, and drainage purposes. F. H. Morehead was elected chairman and A. W. Claussen secretary of the joint committee.

One of the best-attended and most spirited standards com-

Left to right: Sol Einstein talks with Fred H. Colvin and J. B. Armitage

Secretary C. E. Davies congratulates President-Elect McBryde while President Christie looks on

F. B. Heitkamp and L. F. Nenninger stop for the Camerman

The Cameramen Were Always Looking for Small Groups of Officers Authors, and Members

Robert T. Kent with Dr. Lillian M. Gilbreth and her daughter

Around the table after lunch and before a Committee Meeting starts

R. L. Gibson talks his paper over with A. R. Stevenson, Jr.

—and Caught Them Sometimes Off Guard and Other Times Obligingly Posing

mittee meetings was that of the Subgroup on Screw Thread Gaging Practice of Subcommittee No. 5 of Sectional Committee B1. H. B. Hambleton presided in his capacity as chairman and H. W. Bearce served as secretary. Draft material which had been prepared and distributed in advance of the meeting at the request of the chairman was reviewed in detail and a redraft with corrections, changes, and additions was ordered. While the personnel of this committee numbers seven, 26 specialists on this subject were present and took part in the discussions.

The recently formed Subcommittee on Wire and Sheet Metal Gages, H. W. Tenney, chairman, and R. G. Kenly, secretary, held two sessions on Wednesday.

On Wednesday morning, also, the Subgroup on Welding Fittings, Sabin Crocker, chairman, of Subcommittee No. 3 of B16 held a meeting at which 27 were present. That same morning Technical Committee No. 3 on Machine Tapers of B5 held a meeting at which minor changes in ASA B5.10-1937 were made and plans were made for distribution of a Proposed American Standard on Steep (Self-Releasing) Machine Tapers.

A group of three meetings under the auspices of the Sectional Committee on Graphical Symbols and Abbreviations for Use on Drawings (Z32), H. W. Samson, chairman, was held on Wednesday and Thursday. The Subcommittee on Mechanical Symbols met on Wednesday morning; the Subcommittee on Electrical Symbols met on Wednesday afternoon; and the sectional committee assembled on Thursday morning. The net results accomplished at these meetings were the release for vote on approval by letter ballot of (1) the revised series of mechanical symbols including welding symbols, symbols for piping, heating, ventilation and air conditioning, and duct work; (2) the graphical symbols for telephone, telegraph, and radio use; (3) the electrical symbols for architectural plans; (4) control symbols; and (5) graphical symbols for power and measurement.

The largest attendance in the group of committee meetings held on Wednesday and Thursday was scored by the two committees dealing with the revision of the American Standard Code for Pressure Piping. The first meeting was that of Subcommittee No. 2 on Power Piping, A. Iddles, chairman, at which forty were present and the second that of Sectional Committee B31, E. B. Ricketts, chairman, and F. A. Lydecker, secretary, at which more than sixty were present. In fact, the latter meeting was so large that some of the delegates and members of the local committee at the Annual Meeting mistook it for a technical session. Satisfactory reports were received at the latter meeting from practically all of the nine subcommittees, so that early in the spring of 1940 a combined draft of the several chapters in revised form should be ready for vote on approval by letter ballot of the members of the sectional committee.

A subcommittee of Sectional Committee B1 on Screw Threads, R. E. Flanders, chairman, appointed to study the present American Standard B1.1-1935 and to prepare recommendations for changes, held an important meeting on Wednesday afternoon. P. V. Miller presided in his capacity as chairman of the subcommittee and H. W. Bearce acted as secretary. Thirty interested engineers were present even though the membership of the subcommittee numbers only eleven.

While the Sectional Committee on Surface Qualities held a meeting in New York, N. Y., on Nov. 3, 1939 at which its proposed American Standard for Surface Roughness was reviewed and released to the sponsor body, it held a second meeting in Philadelphia on Thursday morning for the purpose of discussing its future program. J. R. Weaver, chairman of the committee, presided and H. J. Wills, its secretary, recorded the actions taken.

Thirty engineers and industrialists attended the Thursday afternoon meeting of the Sectional Committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (B4). J. E. Lovely presided in his capacity as chairman and T. W. Ragan served the committee as acting secretary. The principal business of the meeting was a decision as to whether or not the ISA system should be used as the basis for a revised system of machine fits. The committee finally decided to authorize the appointment of two subcommittees, one to develop a proposed American Standard based on the ISA system and another to develop a proposed system based on present general practice in the United States.

Subcommittee No. 2 on Wrench Head Bolts and Nuts of the Sectional Committee on the Standardization of Bolt, Nut, and Rivet Proportions (B18), A. E. Norton, chairman, held an important meeting on Friday morning after the close of the formal meeting of the Society. It received with regret the resignation of its chairman, Lieut.-Comdr. H. B. Slocum, and elected his successor, Lieut.-Comdr. W. K. Mendenhall, Jr., to the chairmanship. Certain important questions having a bearing on the completion of the present American Standard on this subject, ASA B18.2-1933, were discussed at length and decisions were made which will permit the editing committee to complete the final drafting of the revision and its distribution early next year to the members of the sectional committee for vote on approval by letter ballot.

The annual meeting of the A.S.M.E. Standardization Committee began with luncheon on Thursday. Prof. O. A. Leutwiler, the retiring chairman of the committee, was in the chair. The most important item in Secretary C. B. LePage's report was the statement that during the fiscal year ending October 1 the following six standards were approved by the committees concerned and the sponsors and were passed on to the American Standards Association: (1) Indicating Pressure and Vacuum Gages, (2) Involute Splines, (3) Malleable-Iron Screwed Fittings, 150 lb (revision), (4) Taps (revision), (5) Wrought-Iron and Wrought-Steel Pipe (revision), and (6) Round Unslotted Head Bolts (revision).

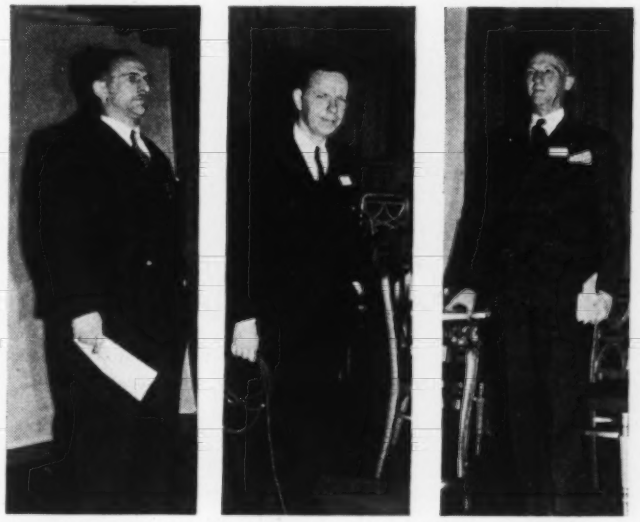
The progress made by the many other standards committees for which the Society is sponsor or joint sponsor is recorded in the standing committee's annual report which is published as part of a separate pamphlet available on application.

Next on the order of business was the election of the new chairman of the committee. W. C. Mueller was unanimously elected to this office. The committee then formally welcomed Prof. T. E. French as the newly appointed member of the committee.

The remainder of the meeting was given over to the transaction of routine business which had accumulated since the last meeting of the committee. Four items of general interest are (1) the confirmation of the nomination by the committee of A. L. Baker to serve as one of the Society's two representatives on the Standards Council of the ASA, (2) the nomination of C. B. LePage as one of the Society's two alternates on this council, (3) the confirmation of the nomination of A. Iddles to serve as the A.S.M.E. Representative on the ASA Mechanical Standards Committee for the two-year period 1940–1942 with A. L. Baker as alternate, and (4) confirmation of the renomination of Geo. S. Case as a member of the ASA board of directors for the three-year period beginning Jan. 1, 1940. These appointments by President McBryde were announced at the Friday meeting of the Council.

POWER TEST CODES GROUP

The first of the technical committees to meet on Monday morning was the Power Test Codes Committee No. 2 on Definitions and Values. This meeting was called primarily to



ON THE SPOT BUT BRAVE—THOMAS BARISH, O. W. HABEL, AND A. M. JOHNSON

THEY'RE PLEASED—R. T. E. ULLMAN, R. L. GOETZENBERGER, H. J. LOBERG, AND R. T. KENT

ANOTHER GROUP LIKES IT—JOHN DOE, J. R. BANGS, R. H. DE MOTT, AND L. P. ALFORD

CAUGHT LOOKING AT THE PICTURES—O. W. BOSTON, R. T. WISE, R. E. FLANDERS, AND M. F. JUDKINS

AFTER THE LUNCH WAS OVER—THE PUBLICATION COMMITTEE MET. AROUND THE TABLE FROM LEFT TO RIGHT, L. C. MORROW, FREDERICK LASK, C. M. PECK, G. F. BATEMAN, A. R. STEVENSON, JR., G. A. STETSON, AND L. S. MARKS

consider certain comments on the final draft of the proposed revision of the Power Test Code publication on Definitions and Values which had been sent to the main committee for vote on approval.

The next in order of time was the Public Hearing on Dust-Separating Apparatus which was guided by M. D. Engle, chairman of Power Test Code Committee No. 21. Seventy-five attended this hearing and largely as a result of the presiding officers' efforts to encourage discussion a considerable amount of valuable comment on the proposed test code was added to the record. The committee held an executive session on Tuesday afternoon to review the stenographer's record of the hearing and to plan for the final editing of the code.

An enthusiastic meeting of Committee No. 17 on Internal-Combustion Engines was held on Tuesday afternoon. Twelve members of the committee were present including chairman Lee Schneitter and F. H. Dutcher, secretary. Good progress was made toward the revision of the present A.S.M.E. standard test code for this type of prime mover.

That same afternoon Committee No. 18 on Hydraulic Prime Movers held a meeting at which nineteen were present. In the absence of chairman S. Logan Kerr, Lewis F. Moody presided and W. J. Rheingans recorded the actions of the committee. With the test code published in July, 1938, the principal business of the meeting was a discussion of certain methods of measuring water.

This year Committee No. 6 on Steam Turbines held its usual breakfast meeting. C. H. Berry, chairman, presided and Francis Hodgkinson led the discussion on the proposed changes in the August, 1939, draft of this important code. Twelve were present.

Important progress was made at the meeting of Committee No. 4 on Stationary Steam-Generating Units, E. R. Fish, chairman. Drafts of a test code for pulverizers and a revision of the test code for the boiler itself including economizers and fuel-burning equipment and the use of the heat-balance method of computation were presented by R. L. Spencer, chairman of the Subcommittee on Coordination. These were discussed at length and certain changes and additions were suggested.

The finishing touches were put on the new Test Code for Gaseous Fuels at a luncheon meeting of Committee No. 3 held on Thursday. W. J. Wohlenberg, chairman, presided and S. B. Flagg led the discussion. The committee expects to be able to release the code to the main Committee on Power Test Codes shortly.

The second meeting of the reorganized Committee No. 13 on a Test Code for Refrigerating Systems took place on Thursday afternoon. This is a joint committee made up of representatives of the American Society of Refrigerating Engineers and The American Society of Mechanical Engineers whose chairman is Prof. B. H. Jennings of Lehigh University. The committee reviewed in detail the present joint test code on this subject and recorded many desired changes and additions. It also discussed the availability of other sources of information and guidance. Five of the eight members of the committee including the chairman were present.

This year the December meeting of the main Committee on Power Test Codes took the form of a dinner meeting which is in the nature of an innovation for that committee. It was held on the evening of Thursday, December 7, and forty members of the main Committee, the individual code committees, and the A.S.M.E. Council were present. Francis Hodgkinson was in the chair and many items of routine business were transacted.

All of the thirteen individual committees which are now at work on new test codes or the revisions of old ones were represented and presented reports. Some of these reports presented by committees which held meetings during the week have been summarized in the preceding paragraphs. However, in addition it should be stated that Committee No. 10 on Centrifugal and Turbo-Compressors and Blowers has, through the activity of Prof. M. C. Stuart's subcommittee, completed the first draft of a Test Code for Fans. Copies of this code will soon be available for review.

By a vote of the main Committee after discussion, the name of Committee No. 11 was changed to "Complete Heat and Power Plants."

When the report of Committee No. 19 on Instruments and Apparatus was called for, Chairman W. A. Carter stated that Part 3, Temperature Measurement, Chapter 3 on Thermocouple Thermometers in galley-proof form was distributed to the members of the main Committee on November 15 for final consideration.

PROGRAM OF ACTIVITIES PROVIDED FOR WOMEN

More than 150 wives and daughters of A.S.M.E. members and other women were the guests of the Philadelphia Section of the Woman's Auxiliary to the A.S.M.E. during the Sixtieth Annual Meeting. A well-planned program for the entertainment of the visitors was prepared and carried out successfully by a capable committee under the leadership of Mrs. J. Page Harbeson, Jr., chairman of the Philadelphia Section.

All the women who had registered up to that time convened in the North Garden of the Bellevue-Stratford at 2:30 p.m. Monday for the Sixteenth Annual Business Meeting of the National Auxiliary under the chairmanship of the president, Mrs. George W. Farny. In place of the recording secretary, Mrs. Charles E. Gus, Mrs. Richard S. Austin read the minutes of last year's business meeting. After the financial report was given by Mrs. A. H. Morgan, the treasurer, the activities of the various committees were summarized by the individual chairmen: Mrs. C. B. LePage, program; Mrs. R. V. Wright, assisted by Mrs. J. Ansel Brooks, educational loan fund and Calvin W. Rice Scholarship fund; Miss Burtie Haar, custodian and publicity; and Mrs. F. M. Gibson, ways and means. It was reported that the Auxiliary now has five sections and a total membership of 285, and that much enthusiasm and activity are evinced in all undertakings of the members. Mrs. Harbeson asked Mrs. Justin J. McCarthy, secretary of the rapidly growing Philadelphia Section, to outline the year's work. Mrs. James H. Herron read an equally fine report for the Cleveland Section; Mrs. Alexander G. Christie spoke for the Baltimore Section; and Mrs. Bernard Toben, as chairman of the Los Angeles Section, presented its report. Since the Metropolitan Section was organized only recently, no report was given.

After the report of the 1940 Nominating Committee was presented by Mrs. G. L. Knight, the chairman, the unanimous election of the following officers was announced by Mrs. C. H. Young, chairman of the Tellers Committee: Mrs. George W. Farny, president (reelected); Mrs. Collins P. Bliss, first vice-president; Mrs. Calvin W. Rice, second vice-president; Mrs. Crosby Field, third vice-president; Mrs. J. Page Harbeson, Jr., fourth vice-president (Philadelphia); Mrs. Harry A. Schwartz, fifth vice-president (Cleveland, reelected); Mrs. Charles H. Fay, recording secretary; Mrs. F. M. Gibson, corresponding secretary; and Mrs. Albert H. Morgan, treasurer. A rising vote of thanks was tendered Mrs. Farny for her inspiring leadership and untiring zeal in aiding the growth of the Auxiliary.

James H. Herron, past-president A.S.M.E., in a short talk suggested that it might be a good idea for the women's organizations of the Four Founder Societies to unite in furthering the social life of the young graduate engineer. Mrs. Vincent M. Frost listed the officers nominated for 1940 in the Metropolitan

Section and Miss Haar, chairman of the Tellers Committee, reported their election. After a vote of thanks to the Philadelphia group for its hospitality, the meeting adjourned to the Clover Room where tea was served to the ladies and members of the A.S.M.E. Mrs. J. Stanley Morehouse and her committee provided this delightful finish to an interesting afternoon.

On Tuesday morning, Mrs. C. C. Baltzly, chairman of the Excursions Committee, provided an interesting three-hour tour through Philadelphia which ended with luncheon at Old Bookbinders, one of the historic landmarks of the Quaker City. The committee arranging the luncheon was under the chairmanship of Mrs. Eugene F. Zeiner. From there the group went to the Fels Planetarium to see the "Christmas Pageant of the Heavens" program and to visit the many exhibits of the adjoining Franklin Institute.

The dinner in the evening was held in the North Garden of the Bellevue-Stratford and proved to be the high spot of the day. Under the capable guidance of the chairman, Mrs. William Oberhuber, the program proved to be full of delightful surprises. Six of the guests won beautiful door prizes and every one present received a little souvenir from Mrs. Walter Wood, the guest speaker, who spoke on "This Beauty and Fashion Business," based on her experiences here and abroad. In conclusion, Mrs. Farny expressed the thanks of the Auxiliary to Mrs. Harbeson and her committee for their hospitable welcome "which outshone that of the city which welcomed the A.S.M.E. with lights on the City Hall." All ladies present hoped that the visit might be repeated soon.

Wednesday morning, the party toured the Campbell Soup Company's plant in Camden, N. J., where a tasty snack and samples were presented to each visitor. Following luncheon in the Mirror Room of Whitman's, which was under the direction of a committee headed by Mrs. Lee P. Hynes, the women spent the rest of the afternoon shopping. In the evening, they attended the Annual Dinner and Honors Night in the Grand Ballroom.

TRADITIONAL COLLEGE REUNIONS

A number of engineering-college alumni groups held dinner meetings in Philadelphia on Thursday evening, Dec. 7. These included Cornell University, Drexel Institute, Massachusetts Institute of Technology, New York University, Pennsylvania State College, Purdue University, Rensselaer Polytechnic Institute, Stevens Institute, Tufts College, University of Michigan, University of Pennsylvania, Villanova College, and Worcester Polytechnic Institute. However, two other alumni groups met in New York City, Carnegie Institute of Technology at luncheon on Thursday and Yale University on Friday evening. Most of the reunions featured talks by prominent engineers who were present, except Admiral Wat Tyler Cluverius who talked to the Worcester group for 15 minutes by telephone conference system. J. P. Harbeson, Jr., served as chairman of the Philadelphia Committee on College Reunions.

INSPECTION AND SIGHT-SEEING TRIPS

Philadelphia outdid itself in the variety of plants which were made available for the inspection of A.S.M.E. members and guests during the week of the meeting. More than 1000 men and women took part in the 11 regularly scheduled plant visits and the four special inspection and sight-seeing tours. The attendance would have been even greater but for the fact that facilities made it necessary to limit the number of participants on some trips. The plans for the plant visits were made by a subcommittee, under the chairmanship of A. G. Kisner.

Approximately 100, mostly women, participated in the sight-seeing trip through the city, in the visit to the Campbell Soup Co. plant in Camden, N. J., and the special historical tour. The most popular trip, if number taking part is any indication, was the visit to the Baldwin Locomotive Works by 188 engineers and students. Next in popularity according to 178 visitors was the inspection of the Westinghouse Elec. & Mfg. Co. plant in Philadelphia. Attendance figures for the other trips were as follows: S.K.F.-Philadelphia Gear Works 107; Edw. G. Budd Mfg. Co.-Link Belt Company 36; Sun Oil Company 127; Sun Shipbuilding Co. 47; Conowingo-Safe Harbor all-day trip on Thursday 33; General Electric Company's switchgear works 45; Leeds & Northrup Co.-Brown Instrument Co. 41; Schuylkill Generating Station, Philadelphia Electric Co. 112; Curtis Publishing Co.-The Beck Engraving Co. 45. Several members also made special trips to the Yarnall-Waring Co. and The Franklin Institute.

TEA IS SERVED

FOURTH ANNUAL PHOTOGRAPHIC EXHIBIT

Arranged by a committee under the able direction of C. E. Bonine, more than 140 photographic prints received from all parts of the country were shown at the Fourth Annual A.S.M.E. Photographic Exhibit held during the week of the meeting. The beauty and arrangement of subject matter of each photograph was brought out clearly with the aid of special reflector-type lamps installed above the prints by the committee. Ten of the prints were selected by the editors for use in MECHANICAL ENGINEERING. Their selection was based mainly on the reproduction possibilities of the photographs which made it necessary to have extreme contrasts. However, both technical and nontechnical prints were picked as follows: First prize, "Falls of the Pilmaiquen, Chile," by R. L. Goetzenberger, Philadelphia, Pa.; second prize, "Casting," by W. F. Weiland, University of Nebraska, Lincoln, Neb.; third prize, "Drop Hammer," by Theodore B. Hetzel, Haverford, Pa.; and honorable mentions, "Tilt Mill," by Mr. Hetzel; "Precision," by S. E. Surdam, Schenectady, N. Y.; "Sailing Free," by L. E. Wagner, Providence, R. I.; "Steam," by John P. Mudd, Midvale, Pa.; "Melancholic Slag," by William T. Reid, Pittsburgh, Pa.; "Reflections," by Willaim B. Updegraff, Eliza-

beth, N. J.; and "Swinging Pendulum," by Ralph Ernst, Columbus, Ohio. These and other photographs exhibited are to be reproduced in this and subsequent issues of MECHANICAL ENGINEERING.

IT'S ALL DONE BY COMMITTEES

Although the conduct of Society meetings comes under the general direction of the Committee on Meetings and Program, a host of other committees assist, and many special committees must be organized to look after the many important details that must be cared for if a couple of thousand engineers are not to be disappointed in smoothly operating arrangements. The men who serve on these committees, and particularly the chairmen, devote many hours of voluntary service to their fellow members for the good of the Society and the profession.

Through a regrettable oversight the name of the chairman of the general committee of members in Philadelphia who carried the burden of the Sixtieth Annual Meeting was omitted from its proper place on the program. Nevin E. Funk, who performed this service, was, however, included in the list of members of the Committee on Meetings and Program. The Society was indeed fortunate that one of the members of the Committee on Meetings and Program resided in Philadelphia and could therefore coordinate both local and Society Committees.

Serving with Mr. Funk on the Philadelphia General Committee were the chairmen of the committees listed as follows:

RECEPTION COMMITTEE: H. A. Hoffer (chairman), V. L. Sanderson (vice-chairman), O. B. Agner, C. C. Baltzly, J. A. Barnard, J. M. Barnes, Wm. L. Batt, John G. Bennett, Jr., Jos. S. Bennett, 3rd, J. H. Billings, C. E. Bonine, L. C. Bosler, Warren A. Brown, Henry B. Bryans, Raymond C. Burton, Clarence B. Campbell, John L. Conner, Harry E. Corl, George E. Crofoot, Thos. E. Cushing, Kern Dodge, Dawson Dowell, H. E. Ehlers, Donald C. Exler, C. C. Franks, N. E. Funk, John A. Goff, Charles Gotwals, L. N. Gulick, F. T. Hague, J. P. Harbeson, Jr., Henry S. Harris, E. L. Hopping, J. E. Hunt, Lee P. Hynes, K. M. Irwin, C. C. Jones, L. H. Kenney, S. Logan Kerr, L. T. Klauder, C. N. Lauer, H. P. Liversidge, P. S. Lyons, Alfred C. Maule, J. Stanley Morehouse, D. W. R. Morgan, Wm. F. Oberhuber, Charles Penrose, George F. Pettinos, T. M. Pomeroy, Jr., Philip J. Potter, Walter Samans, Coleman Sellers, 3rd, W. A. Sloan, Robert L. Spencer, Wm. Jas. Stevens, H. B. Taylor, Donald F. Torrey, Franklin E. Washburn, A. C. Wood, D. Robert Yarnall, H. Russell Young.

HONORS NIGHT COMMITTEE: D. Robert Yarnall (chairman), J. Harland Billings, George E. Crofoot, H. E. Ehlers, Conrad N. Lauer, Harold T. Moore, John P. Mudd, Charles Penrose, Morton M. Price, Albert C. Wood.

INFORMATION AND REGISTRATION COMMITTEE: A. M. Quinn, John T. Barron, H. C. Tanner, Ralph M. Alexander, Robert J. Lee, J. W. Little, L. S. Divan, W. A. Sloan, Cyrus R. Harvey, C. B. Irmer, Richard Squires, Robert K. Knipe, W. F. Mitchell, G. K. Fisher, E. D. Doyle, E. W. Bender, Jr., Joseph S. Pecker, Walter W. Goehring, Lorenz J. Herwegh, John B. Glasby, H. M. Brown.

LOCAL FINANCE COMMITTEE: W. L. Batt (chairman), John E. Zimmermann, Charles E. Brinley, Conrad N. Lauer.

HOTEL COMMITTEE: Coleman Sellers, 3rd (chairman), W. T. Abercrombie, Jr., C. H. Coogan, C. M. Hoffner, W. R. Miller, J. H. Peterson, J. S. Rabe, E. F. Zeiner.

ENTERTAINMENT, PLANT TRIPS, AND LADIES' COMMITTEES: D. S. Walker (chairman); ENTERTAINMENT: H. M. Wilson (subchairman), R. M. Bassett, L. C. Bosler, B. M. Thomas, Samuel Blum; PLANT TRIPS: A. G. Kisner (subchairman), J. Harlow, D. W. R. Morgan, H. Groothuis, C. E. Sykes.

BANQUET: C. W. E. Clarke (subchairman), K. M. Irwin, W. V. Sauter, R. C. Burton, W. R. Lurtey, Robert Knipe, George Fisher, Charles Hoffner, S. H. Libby.

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(*Left to right:* G. Maertz, H. A. Hoffer, G. C. Graf, D. F. Schick, Jr., C. W. E. Clarke, C. C. Jones, S. T. Mackenzie, N. E. Funk, chairman, J. P. Harbeson, Jr., A. G. Kisner, D. Robert Yarnall, D. S. Walker, Lee P. Hynes, J. M. Barnes, C. E. Bonine, and J. McCarthy.)

LETTERS AND COMMENT

Brief Articles of Current Interest, Discussion of Papers in Previous Issues

Unionization of Engineers[1]

To the Editor:

Unionization is not a new idea. Back in the fall of 1919 the late Prof. Peter Gillespie of Toronto University and the writer led a debate on the subject before the Toronto Section of the Engineering Institute of Canada. Professor Gillespie opposed unionization and was joined by the majority of the engineers present. The writer took up the cudgels in favor.

Looking back over the report in the *Canadian Engineer* on what took place, it is evident that on some subjects engineers are less inclined to reason than on others. Like religion and politics, there are some subjects on which people can argue, perhaps, but not debate very well.

Those who opposed unionization in this ancient debate did so from conviction. They did not particularly concern themselves with answering arguments in favor of unionization, they contented themselves with saying they were against it. That seems to be the attitude of the majority today, but today the majority is smaller than it was and tomorrow it may not be a majority.

Aesop wrote a fable about a bat who was invited by the mice to be their king. Indignantly he declined, proclaiming that he was no mouse, but a bird. When he tried to join the birds they drove him away.

Few engineers head business organizations. Many work for corporations, large and small. May it not be that in opposing unionization engineers may be passing up the opportunity to provide labor with just that leadership which most of the opposition to unionization admits that labor lacks?

There is less to fear in unionization than those who oppose it are able to prove. There are closed professions which are so similar to unions that only skill in hairsplitting will reveal a difference. And members of these closed-profession unions display notable unselfishness on occasion or conspicuous public spirit. Mere membership in a union will not make engineers less desirable citizens, but they may make unions less undesirable.

Whether professional societies like the A.S.M.E. can properly and profitably concern themselves with what their members earn may be debatable. Part of the membership are among those who hire and pay engineers. The rest work for such as they. Both groups join to talk shop and pleasure and profit result. In a union both groups would not meet. It may be that the union and the society have their places. Certainly any union of engineers is likely to differ very widely from the usual conception of the average union.

William Snaith.[2]

To the Editor:

The excellent article by Mr. Herron will, I am sure, call forth an avalanche of replies as the subject is of concern to many, in particular to young engineers. It is timely. One of our sister organizations, the A.S.C.E., held a meeting on that particular phase of engineering, the professional problem.

Yet before one can make suggestions as to how an engineering association should be organized to advance the professional standing the position of the engineer in industry and society has to be analyzed. Only a careful and objective survey will reveal if there is a need for such an organization and how it can achieve the aims for which it has been founded.

In a discussion of unionization of engineers the first question is why engineers join a group closely allied to a large labor union. The answer to that problem is easily found. It is to improve their economic position. As stated in Mr. Herron's paper, younger engineers, who I believe are those graduated in the depression years, have joined. If a survey of their income were made, it probably would be found that their remuneration is that of a shophand and has not increased too much above the average income paid by industry at large. Their income has been stagnant and the experience gained in industry after a college course has not meant an increase in their salary.

In my eyes their joining the labor movement simply means that they are dissatisfied and in their opinion unionization promises more pay.

The question then arises whether the position of an engineer is improved by joining such an organization which looks upon itself as the defender against an all-powerful management. Right there lies the crux of the matter.

The position of the engineer in industry is unique. He is charged with a responsibility which directly affects the cost of the product and with it the earnings of the company. He has to have the confidence of the management so that decisions can be made freely. This trust placed in him is essential for the independent work, which elevates his work from an occupation to a profession.

It is questionable in my eyes whether an engineer who gives away to an outsider his right to argue about his personal matters with the management will be considered competent to take care of other people's, that is, his employer's, affairs.

Viewing the situation from another angle, union membership draws a line between employers, who are defined as persons with the right to hire and fire, and employees. In the case of engineers this would mean in many instances that the older more experienced men, from whom the younger men should learn, could not belong to the same organization as the younger engineers.

I believe that this short review brings to light some implications which are connected with unionization and are so grave as to prohibit union membership to an ambitious engineer who does not see in a raise, if any, an advancement, professionally, and in his status in society. Yet there is undoubtedly room to improve the position of the engineer, and some kind of organization may be found to advance it.

Groups such as law and medicine have achieved professional recognition which includes an obligatory education and final state examination and license. This procedure has been set up to safeguard the public. In our line of work in which most of the engineers are employed by industry no public necessity exists to demand licensing of all engineers, though

[1] A group of letters commenting on an article "Unionization of Engineers," by James H. Herron, Mechanical Engineering, vol. 61, no. 11, November, 1939, pp. 788–789 and 822.

[2] Chicago, Ill. Mem. A.S.M.E.

from a personal point of view it may be desirable to obtain a license.

Whether state license or not, it cannot be said that a seal and registration establishes a profession. A profession depends on something more. It is the recognition of society that men engaged in practicing law and medicine try to serve not only their personal interests but have the interest of the community at heart.

Looking upon a profession with that in mind, the professional status is in the final analysis an honor bestowed on its members by society for serving everybody alike with equal zeal.

Executing a mere technical task successfully is only a prime requisite for professional service. The effort of a profession has to be directed to solve nationwide problems in which the people are interested.

Our cooperative effort should naturally be in line with our work and directed toward solving some of the difficulties which have been brought about by industrialization. The public is looking for guidance and information on everyday questions such as closed shop, strike, National Labor Relations Board, industrial taxation, not to mention unemployment. But we as engineers have not expressed our views in a fashion commensurate with our training—unbiased. No national meeting of ours demands the wide attention as that of the American Bar Association or American Medical Association. Why? Because we do not discuss the relation of our work to the people as a whole.

Not before we are able to render public service by having an organization which has as members men able to give impartial advice, have we a profession. And now to the organization we need. The A.S.M.E. and the sister societies can tackle the job.

WALTER L. FLEISCHMANN.[3]

TO THE EDITOR:

I believe Mr. Herron has stated the situation quite clearly in his discussion of professional and union ideals. Engineering purposes, functions, responsibilities, relationships, ethics, and ideals seem to be quite different from union purposes, functions, responsibilities, relationships, ethics, and ideals. There is very little in common.

Even if there were some common meeting ground, the methods to be used in gaining a certain end surely would be far apart based upon the character of the two groups.

President Wickenden of the Case School of Applied Science has made a distinction between the so-called "engineering fraternity" and "professional engineers," which it seems to me is worth while keeping in mind. The professional engineers are part of the engineering fraternity, but all those belonging to the engineering fraternity are not members of the professional-engineers' group. I believe that a line of demarcation for professional engineers might be established even though the exact location of the line might have to be arbitrary at the division point.

The advancement of the engineering profession should come through professional channels and not through union channels. The advancement of the engineering profession depends upon the professional engineers and not upon the engineering fraternity. Such advancement should concern the engineering societies and the engineering schools.

The creation of a professional spirit should be started in the engineering schools. The precedent set by the medical and law schools in that respect might well be followed. Along with this creation of a professional spirit, and as a part of that spirit, there should be developed a comprehensive understanding and feeling for the engineering standards of ethics and conduct. These should be made vital in the engineering school through cooperative effort of the schools and the engineering societies.

I believe the young engineering graduate upon leaving the engineering school to enter practice should be given a preferred professional status through his period of "internship" and every effort should be made to preserve this preferred professional status during the first five years after graduation. In order to have the professional status more desirable, I believe everything should be done, that can be done on a professional level, to enhance the financial returns and to improve the professional development of the engineer.

I am in favor of bringing together all the engineering societies and engineering educational institutions along with any others concerned, for the purpose of studying the unionization problem, particularly to clarify the relationships between employers, engineers, and unions in such a way that we can maintain a completely independent professional status without the danger of falling into the maelstrom of union activities.

R. L. SWEIGERT.[4]

TO THE EDITOR:

As a recent and youthful entrant into The American Society of Mechanical Engineers, I wish to express the opinion of the "Younger Set," as my experience, observation, and discussion with others see it. It is granted that I lack the experience and the wisdom which the passing of years has brought to the older members of our organization, but an insight into the thoughts and conclusions of new members should be of interest.

Should the engineer join a labor union or a similar and related group such as the Federation of Architects, Engineers, Chemists, and Technicians? The young engineer answers with a firm, "No." Will the next few years find the majority of engineers belonging to some form of a collective-bargaining agency? Opinion is divided, but the affirmative seems to hold a substantial margin. Should the status of the engineer be firmly established and enforced by The American Society of Mechanical Engineers? Again the answer is an overwhelming, "Yes."

Let us traverse the field of relationship which the young engineer has had with his profession and with The American Society of Mechanical Engineers. The student branch of the Society provides the first contact with the A.S.M.E. It is here also that, through lectures and literature, our embryo engineer learns of the profession for which he is preparing to become a part. Under capable and conscientious faculty guidance, pride and interest are developed for the profession and for the organization. The A.S.M.E. takes an important part in the All-Engineers' Smoker, and, acting in close cooperation with the A.I.E.E. and the A.S.C.E., has an influential role in campus government. A thoughtful executive committee is careful to give each member an active part in the organization and to conduct the activities and publicity of the society in a manner which makes membership highly desirable.

Then comes graduation. A small envelope, distributed by the honorary chairman, discloses that the graduate has been elected to the rank of junior member and, by payment of a $10 fee, can enjoy all the rights and privileges thereof. The chairman of the local section to which he is assigned sends a letter of welcome and a notice of meeting dates. All is well. Enrolled in the great profession of engineering, a junior member of The American Society of Mechanical Engineers, for what more can a young man ask?

However, the setback is not long in coming. The first meeting is interesting from a technical standpoint, but terribly disappointing in that *not one engineer from the plant is present*. A bit crestfallen, our junior member returns to his work and,

[3] Bloomfield, N. J. Jun. A.S.M.E.

[4] Atlanta, Ga.

at opportune moments, makes careful inquiries of his superiors as to their opinion of the A.S.M.E. A few of them still belong, but have never taken an active part. Most of them have lost membership and interest as well.

The concensus of opinion is that most of the technical information can be obtained through current publications and they feel that other benefits do not merit the cost of membership.

These are men who, by their position and display of engineering ability, win the respect and admiration of the young engineer.

Consider the plight of the recent graduate who secures employment in the field of plant operation. In line with the age-old custom, he is started at the bottom. His work is of a nontechnical nature and, under ordinary circumstances, considered as a steppingstone to better things. Routine tasks are performed in a manner which meets with approval of superiors. Suggestions for improvement in operating methods are found to have merit, and the chief engineer makes comments which are favorable.

However, a new development is taking place. The workers of the plant have become unionized, and their seniority rights have been recognized by the company management. The fact that a man holds an engineering degree makes no difference to these nontechnical men. To them the only claim to promotion is length of service. Membership in the A.S.M.E. commands no prestige.

Does the young engineer want to acquire membership in a labor union or affiliated organization? "No!" Will the next few years find the majority of engineers belonging to some form of collective-bargaining agency? The affirmative carries. Should the status of the engineer be firmly established and enforced by The American Society of Mechanical Engineers? The decision rests with you, our senior members.

CLIFFORD W. WELSH.[5]

TO THE EDITOR:

From past and present observations I cannot see how any man, especially an engineer, professing any degree of intelligence, could think of improving his status in the long run, either ethically or financially, by joining a labor union.

One has only to review the recent "slow down" tactics employed by the C.I.O. at Chrysler to brand this kind of procedure as un-American, unscrupulous, and uneconomic. Unions believe in the doctrine of shorter hours and higher wages, which makes for lower production and higher costs. An engineer, on the other hand, is taught that lowering of costs through greater production is an economic achievement.

How can the two divergent ideas ever meet on a common plane?

JAMES D. CUNNINGHAM.[6]

TO THE EDITOR:

I received a letter from Dean C. J. Freund of the Committee on the Economic Status of the Engineer, asking me to write you briefly my views on the question of membership by engineers in unions. I have not had the time to give this matter any thorough study, but I am glad to give you my opinion based only on a superficial consideration of the matter, for whatever it may be worth. I have read the paper by James H. Herron on the "Unionization of Engineers" and I am in general agreement with his viewpoint. My view may be summed up in the statement that I believe the aims of the labor unions' movement and the ideas behind it are not compatible with the true professional ideals that should govern the engineering profession.

BARNETT F. DODGE.[7]

TO THE EDITOR:

The discussion of the unionization of engineers is not only long overdue, but it is hard to understand how the Committee on Economic Status of the A.S.M.E. could disregard the issue up till now. The explanation evidently lies in the old standards, ideals, and prejudices dominating the minds of professional people, consequently these standards should be examined before discussing the merits of unionization.

Standards of human behavior are not eternal; they are the result of a long evolution, the same as all civilization and culture. The standards of the cave man were very simple and primitive, and the development of standards to their present grade is due to practical, material necessities and conditions. It happens also that such standards are out of place in some localities, or that they become void and obsolete at certain times or even once for all. Consequently, the origins of such standards, which are at the same time their justification, their raison d'etre, should be continuously reexamined and kept before our eyes to ascertain whether they should be maintained under present conditions. Unless the reexamination gives a well-founded logical reason for maintaining the standard, the latter should be dropped, otherwise it will become a handicap, an inhibition, a shackle to progress.

On this basis all the arguments of the "should" type, like "The engineer's first objective should be to work for the common good," are to be excluded from the argumentation unless a good reason be given why this "should" be more so in the case of the engineer than in the case of, say, the weaver. On the other hand, since such standards undeniably exist, their origins should be investigated even if they are outdated, if only to demonstrate it to those who still believe in them that they are obsolete. Such an investigation and explanation are offered here in a nutshell.

Why is it that these well-known standards and ideals apply to the learned professions only, and not to blacksmiths, farmers, and so forth? How did this come about? One of the reasons is possibly that these professions are so interesting and fascinating to those mentally equipped to pursue them that professional men were induced to practice their professions even at some sacrifice on the material side while blacksmiths are blacksmiths and bear the hard physical work because they cannot do any better. On the other hand, since the blacksmith does not work for the love of it, he at least wants to be properly paid. As for the merchant whose occupation is devoid of mental exaltations, he is making money for money making's sake, and consequently monetary sacrifices are against the fundamental objective of his endeavor. The enthusiasm of the professional man for his work, however, should not become with him a weakness on the material side since this would harm him and society as a whole.

Another source of special standards for professional men can be found in the old spirit of caste dating from the days before the principles of democracy began to spread. Professional men came from a comparatively well-to-do class, for studying was expensive, and they brought with them the prejudices of that class. They learned from the nobility, of which they were mostly members, the slogan, "épatez le bourgeois," that is "dumbfound the burgher," for which purpose the emphasizing of special standards, of idealism and unselfishness, appeared to be a good means. Contrary to all these standards, the independent consulting engineers whose position represents all the characteristics of the professional man, much more so than that of the employee engineer, adopted long ago schedules of fees. The American Institute of Consulting Engineers has such a schedule in its booklet published in 1928,

[5] Whiting, Ind. Jun. A.S.M.E.

[6] Chicago, Ill. Fellow A.S.M.E.

[7] New Haven, Conn.

"for the guidance and protection of members of the profession and their clients." The Essex County Chapter of the State Society of Licensed Engineers and Land Surveyors of New Jersey adopted a resolution in 1927 according to which ". . . no member of this Chapter will charge less than the minimum fees set down in said schedule." Other societies of licensed professional engineers have similar arrangements.

The argument that thinking too much about material rewards diverts the engineer's mind from constructive work, and "cramps his professional style" would lead employers of engineers to the idea to pay little to their best men, lest a raise should spoil them. On the contrary, we see that employers pay more to their better engineers, and they know well that they do not lose by doing so either. Furthermore, how can a man be expected to do high-class mental work if he has to worry about the question of how to make two ends meet in his household? This is best illustrated by the story of the professor of astronomy, who had a yearly salary of $3600, who approached the president of the college for a raise. The president asked him jokingly, "Why should a few hundred dollars make a difference to a man who is used to figuring with trillions?" "My wife is no astronomer," answered the professor.

The claim that the professional man, being a "gentleman and a scholar," should have different principles when it comes to material compensation has no sound foundation at present, and being obsolete, it maintains itself only because it has become a fetish. Even in the good old idealistic times when slogans like "noblesse oblige" were created people spoke dejectedly about a *titulus sine vitulo*, a title without the necessary small change.

What is most surprising, engineers who would not use a piece of material unless it was reliably tested, who would not apply a mathematical formula without checking it, who see old scientific principles being rejected very often for new ones, stick to age-worn, obsolete slogans and prejudices and are inhibited by them.

The great change and difference between the old-time independent professional man, lawyer, doctor, and even engineer is that the mechanical engineer of today is mostly an employee. A count of several hundred members of the A.S.M.E. taken at random in the membership list in various localities shows that about 88 per cent are employees. If we include the mechanical engineers who are not members, this figure is very likely much higher as it is the little employee engineer who cannot afford to join the society. In other lines of engineering this figure may be somewhat different, according to whether the engineers in those lines are mostly employees or not. There will be more independent men among architects because building houses is not a mass industry. The same is true to a certain extent of building bridges and highways, for which reason there are likely to be more independent civil engineers.

Now it is a well-known law of nature that every animal behaves according to how it procures its food, that is, its living. Once we recognize that the great majority of mechanical engineers are employees and not entrepreneurs, that is, they earn their living by working for temporarily fixed salaries and not by investing capital for profit, it follows that they should adapt methods that proved to be efficacious with employees. Thus it is not accidental that the mechanical engineers in the Detroit area working for the automobile industry, the greatest mass-production industry in the world, were one of the first engineering employee groups to establish some six years ago the "Society of Designing Engineers," having a membership now approaching a thousand and affiliated at present with the Federation of Architects, Engineers, Chemists, and Technicians, a C.I.O. organization. Apparently this caused no harm to the common good either, for the design of automobiles went on improving at the same rate as it did before the society was organized. The treatment of the members of the society by the employers, too, indicates that this is a full-fledged union as the La Follette Senate Committee to Investigate Civil Liberties unearthed a case of labor spying in that society by a draftsman for which he was each week duly rewarded. Naturally, the society secured great benefits for its members, otherwise it could not have grown and existed after six years.

There are engineers, who, not being able to find a place for their profession in the fundamental framework of the economic system, as they know that engineers do not represent capital, at the same time shrink from classifying it as labor and resort to a fallacious changing of a fundamental tenet of classical economics by declaring that the factors of production are capital, labor, land, *and management*, with engineering included in the latter. The error lies in the confusing of "management," which is a function, with the economic status, which in this case is that of a salaried employee, since a man is equally an employee whether he manages a drafting office or runs a lathe.

These forced explanations are the result of a meekness and an inferiority complex resulting from long economic oppression. Engineers suffering from it will find all kinds of excuses when it is pointed out to them that other people with brain power, training, and even ethical background much inferior to theirs are earning considerably more. They try to justify such conditions by citing longer working hours and a number of other things, as though engineers, too, would not be willing to work longer and do anything that is wanted provided the compensation was forthcoming. They fail to see the great social injustice that lies in the fact that, for instance, the enriched tradesman of the butter-and-egg man type owns a large fleet of costly trucks, while the engineer can hardly afford a modest but still respectable looking little car. The highest type of engineer is the inventor, and yet the fortunes and estates of an Edison or Graham Bell amount only to 1 to 2 per cent of the fortunes accumulated by some real-estate speculators or fur traders while the proportions prevailing at the top of the ladder are the same at the bottom rungs as well. That this is due to "business ability" is no excuse, for inventing means much more to the common good than the business ability that manifests itself mainly in the enrichment of the owner of such ability.

Speaking of unions in general it must first of all be remarked that they are not un-American if this is a consideration at all. According to the Encyclopedia Americana, heading "Labor," the historical section tells about the Cordwainers' Union around 1790 in Philadelphia, the Shipwrights', Carpenters', and Tailors' Unions around 1805 in New York, and many others, also about "turnouts," that is, strikes. Lincoln declared in 1860 in New Haven: "I am glad to see that a system of labor prevails in New England under which laborers can strike when they want to."

Even if unionism would be a foreign principle introduced only recently into this country from Europe, this should be no reason for rejecting it. We may be far ahead of the old world in every respect, but Europe has one experience we do not possess, and that is: What may happen, what could be done, and what should be done if the place becomes crowded. It is true that the United States is far less crowded than Europe physically, but it is at least as crowded economically, as shown by the great number of unemployed, the concentration of economic power into a few hands in many fields, and that this concentration in newly started industries is accomplished in a very short time.

Unionism is not contradictory to the

Darwinian principle of the "survival of the fittest" as Darwin himself applied the principle primarily to groups and not to individuals and declared that the herd, flock, or group in which mutual assistance is developed the most will survive. In this respect the working class sets the most amazing examples of solidarity not only by organizing to attain certain wage levels, but also by collecting funds for the support of strikers and their families and by financing campaigns to the extent of many hundreds of thousands of dollars to organize other trades.

It is true that unionism has its outgrowths not only in using methods and tactics that may appear objectionable, but also in introducing principles that seem to go against the public interest, like, for instance, the reduction of working time before everybody in the country has attained a certain minimum standard of living just to spread employment. On the other hand, if the captains and generals of industry, these hundred-thousand and million-dollar-a-year brains could not solve the problem of unemployment, nothing but a very blunt way of dealing with the problem can be expected from the brain of the ten-thousand-dollar-a-year labor leader, or a twelve-hundred-a-year laborer, with whom maybe only two hundred dollars a year go for brain, the rest for brawn.

On the other hand unions serve the common good by having a great stabilizing effect on economic conditions by maintaining and developing the purchasing power of the masses. This is so much more important as the only real market of the United States is the United States, because our total foreign trade is not more than somewhat over 5 per cent of the total turnover. To this it must be added that 90 per cent of the people working in trade and industry are employees, or 75 per cent when farming is included. The whole economic power of the population, producing and purchasing together, can be considered as a piece of land that does not belong to anybody in particular, consequently everybody tries to get as much out of it as possible without caring about the preservation of the fertility of the soil, which represents the purchasing power. This leads to a *Raubwirtschaft*, that is, to an "economy" robbing the soil, resulting in economic crises. Unionism is the only movement trying to preserve the fertility of the soil, that is, trying to preserve the purchasing power of the masses and to keep it in step with the ever-increasing production.

Considering the engineer as a union member, the first advantage which offers itself to him is collective bargaining. Compared with this, if we picture the job-seeking individual engineer negotiating with the representative of the 300,000 or more shareholders of a modern mammoth corporation, it will appear how hypocritical and ridiculous is the idea of individual or "man-to-man" bargaining under present conditions.

The argument that the union takes away the individuality of the engineer can be countered with the fact that the greatest individualists, namely, musical artists, have very strong, practically 100 per cent unions. One of them, the Associated Musicians of America, an A.F.ofL. affiliate, includes all the symphony and other orchestra musicians, up to and including the leaders, of first violins, or concert-masters earning over a thousand dollars a month. The union represents their interests toward operas and broadcasting companies. The greatest soloists, whose fees per appearance on the concert stage run into one or more thousands of dollars and who possess and play instruments worth hundreds of thousands of dollars apiece, are all members of the American League of Musical Artists, also affiliated with the A.F.ofL., which represents their interests toward the concert managers. Even the sharpest music critic and the greatest connoisseur could not detect in their individual interpretation of the great classical or modern masters any equalizing effect of the union to which they belong. The great Broadway and Hollywood stars are likewise all members of the Actors' Equity and other unions. The salaries of these people are all different, as the union fixes working conditions and minimum fees and salaries only, and has never prevented an employer from paying more if he thought it worth while. Many engineers probably consider artists as just Bohemians, mere ornaments on the structure of society, of which the engineers themselves are the pillars; and yet they can learn a lesson from them when it comes to solidarity and sound economic procedure.

Whether a union can be formed within the framework of the professional society will depend on whether certain difficulties presenting themselves especially at the beginning of the movement can or cannot be overcome. The first difficulty is that the professional society has among its members employees as well as employers and their representatives with most of the officers belonging to the latter categories. The employers' representatives are usually employees themselves, but will find favor in the eyes of their employers according to how cheaply they can get work out of their subordinates, which makes them antiunionists. This situation prevents those who are primarily interested in forming a union, that is, employees who are not in charge of hiring and firing engineering help, from manifesting their opinions and wishes in connection with the question of unionizing, since they are afraid to jeopardize their positions and future careers. Considering the general tone prevailing in offices in connection with the union question, this fear is very well justified. For this reason the only way to deal with the question in a fair and democratic manner would be something like this: Open wide the columns of MECHANICAL ENGINEERING for a discussion of the question, even to anonymous articles, as apparently many a member needs an eye opener on most of the points. Next, decide with a secret ballot whether there are a sufficient number of members who approve of union activities in the Society to warrant the formation of a committee to start such activities. The committee should consist of members whom the rank and file can trust to keep communications private until such time when unions of engineers will be generally recognized, so that this recognition together with the legal protection against dismissal and discrimination for union activities should be a sufficient guarantee against jeopardizing the present and future status of the engineer in his position. At the same time, members who are in charge of engineering offices with many employees can propose the legal procedure of deciding by means of a vote whether those working in the office want to belong to a union, and if so, whether it should be the one proposed by the professional society or some other group.

Once the movement has been started in this manner and gains momentum, it will then be time to decide on details, such as whether professionals and subprofessionals should be in the same union. It seems that an organization can represent the interests and take care of the wishes and grievances of an engineering office better if all those working in the office, engineers as well as draftsmen, back the issue.

Some advocates of the unionization of engineers even see times coming when machinists and others of a plant will refuse to work after a blue print unless it has a union label on it. This may seem to be terroristic on the part of labor, but on the other hand it would assure the engineer of the backing of all the workers in the plant, which means much more than the backing of the office force only since the latter might be laid off in toto and replaced by others; while no factory manager would prefer

to lay off all his workers rather than remove a grievance of one of his engineers.

In this world in which employers are organized in their trade associations and manual workers in their trade unions, the professional man will be crushed between these two milling stones unless he gets organized himself. He would be the dupe of society if he did not. On the other hand, if he did join a union, he would take a great step toward a better income and greater security. He will be able to found a family earlier, to bring up children and educate them properly, which is very significant if we consider that according to statistics of intelligence tests and other sources of information the children of professional men rank are above the average. Thus if the professional man does all he can to promote his material welfare, he will serve the common good and will be helping to improve the race as well.

ANDREW A. BATO.[8]

TO THE EDITOR:

At the request of C. J. Freund and others of the Committee on Economic Status, I am writing you very carefully but incompletely as to what I think as to Mr. Herron's paper and the subject of labor relations very generally. I find I cannot do this unless I give at least equal status to the responsibilities and ethics of the employer. It is not a one-sided proposition. There is a code of fair play equally dependent upon the employer and employee.

This is gradually percolating. The engineer is not and cannot be, in the direct sense, anything like a referee, and any attempt or interpretation of a code of ethics that attempts to set him up as one is abortive and futile. The engineer, I hope, is a director of forces—a professional guide for intelligent direction and appreciation. He is, in my conception, an artist, a creator, a servitor of the masses, and his reward should be the appreciation, honor, and recognition of his fellows.

His primary duty is conception—the picture of the complete product. His relations are as acute to labor as to those he serves—perhaps they are the same people. The employer, in a fair division, takes only his fair share. He is not a profiteer; if he is, it is better that we recognize it before we are too late.

All cannot be said to be on the side of labor. Too often they are shortsighted and unfair as the employer may have taught them to be. They have no professional pride or concept beyond a guild sense. They are selfish and too utterly shortsighted. I once offered to hand my business over lock, stock, and barrel to labor. They were to have the business and its secrets, and its profits, if any. There were no deficits or debts to assume at that instant and we were bankrupt, although we afterward pulled out, but through our own efforts.

When labor found that they would have to assume the responsibilities for their own pay (if any) they folded up. We tried to furnish the nerve for them by offering to teach them, at no charge, to run the business. They didn't have even enough nerve to assume the responsibility of their own wages, let alone any overhead. They are just not equipped by education or background of any sort as yet.

This is no reason for us to desert them, and we cannot do it without exposing ourselves to worse charges than we are laying upon them. I suppose we must realize that, in a sense, they are children and must be so treated—not imposed upon, but helped. This idea is *fundamentally one of service* and it is the outstanding and true professional idea and concept, and we must never forget it. It is the concept that will rescue humanity from the morass that some types of selfishness have put it in. But we must be sure that our skirts are clear—very sure.

WM. LYLE DUDLEY.[9]

The Engineer in Public Service

TO THE EDITOR:

It is most refreshing to have from Commissioner Byrne such an urgent invitation[10] to professional engineers to participate more actively in the civic affairs of their city, county, and state.

This same appeal has been made frequently during the last decade, chiefly emanating, however, from the faculties of our engineering schools and designed to indicate to their graduates a field of social activity for which their education and subsequent experience as practicing engineers qualifies them to enter and to contribute much to the general public good.

In the Newark, N. J., area, the writer is pleased to state that many engineers have been and are doing their bit, gratuitously, as working members of the local and state chambers of commerce, on boards of education, planning boards, zoning commissions, and hospital boards. However, there is room for a more general participation of engineers in these and other public and quasi-public undertakings. Encouragement from those occupying high places in public life and who have the esteem and respect of their constituency to the extent enjoyed by Mr. Byrne is a reassuring sign which we as engineers should welcome and to which we should respond.

As a Commissioner of the City of Newark, he is endeavoring to make the government of our city a more inspiring object for the support of engineers and other citizens. In this effort, he needs all the assistance available from fact-minded engineers willing and able to contribute such service.

There are few public undertakings which would not benefit in having applied to their consideration the logical reasoning which must be exercised by the engineer in the study of purely engineering subjects. Therefore, we should not limit our interest in public affairs to engineering projects alone.

The great majority of engineers are employees of industrial or public-utility organizations and, unlike the lawyers, the physicians, and the architects, they lack a personal contact with the public whereby their intellectual abilities may be truly appraised.

An active participation in community affairs affords the opportunity to acquaint the public with the qualities of mind which go into the making of an engineer and to acquire a better appreciation of the worth of the engineer as a useful citizen.

It enables him to demonstrate the truly professional status of the engineer as ministering to the public welfare, and it tends to his own better understanding of the general public reaction to engineering developments. The writer would not advise that the young engineer, with only a few years' experience in his profession, volunteer his suggestions as an individual directly to a public body, public official, or to a welfare organization, but that his initial effort in service be by joining one or more of those social agencies devoted to some phase of public service. There he may work in the ranks until such time as age and experience justify a respect for his views.

F. O. RUNYON.[11]

TO THE EDITOR:

It has been very interesting and instructive to get Commissioner Byrne's view-

[8] East Orange, N. J. Mem. A.S.M.E.

[9] Seattle, Wash. Fellow A.S.M.E.

[10] "The Engineer in Public Service," by Joseph M. Byrne, Jr., Mechanical Engineering, October, 1939, p. 742.

[11] Consulting Engineer, Runyon & Carey, Newark, N. J. Mem. A.S.M.E.

point on this particular subject, a subject in which the writer not only has had a deep personal interest, but with which the Newark College of Engineering has been experimenting for the last five or six years.

An attempt to analyze the reasons why younger people are not interested in the broader field of politics, aside from their profession, is an extremely difficult task. We are forced to conclude in the main that the answers are not to be found along the line of logical and rational factors but largely in the field of the traditional and the emotional. It is doubtful if today in our democracy many of our important problems are solved on an entirely rational and logical basis. When we deal with those more fundamental, those more basic emotional factors, we are, no matter how fundamental our education, faced with a very intricate problem, so intricate that any attempt at really basic analysis forces us in a remark of this kind to oversimplification.

President Ripley of the Santa Fe once said that it was impossible to make an employee loyal against his own interest. For our purpose, if you would change this statement slightly and say that you thought it was impossible to make a young man loyal to an abstract principle against his own financial, economic, and emotional interest, you would have something which was almost basic in the functioning of our democratic form of government. If we couple with this the one thought that perhaps the only time when we can count on loyalty to our form of government is in the time of a great emergency, we shall have two statements which together will carry us far in the solution of this particular problem.

Some statements seem to flow directly from these two propositions. One is that on the part of young people, loyalty to an individual is easy, loyalty to an abstract principle hard; loyalty to constructive and dramatic leadership is comparatively easy of accomplishment; loyalty in time of stress, in time of national emergency, is easy; loyalty in the humdrum affairs of the everyday give and take of a world of trade and commerce and peace is hard.

This is the reason why all the year long we let our political matters slide and get all worked up a few weeks before the budget is approved. It is the reason why in times of peace we are apathetic, in times of war we are very loyal to America. This means, of course, that fundamentally our politics is emotional, not rational. It explains why political leadership is so tremendously important; it explains why the dramatization policy is so tremendously important to young people, and perhaps it gives some light on the inherent desire of youth for action, something to be done, something to be accomplished; and perhaps it explains in large measure why youth is drawn irresistibly toward the programs of those parties or organizations which offer something personal, something active, in which something may actually be done and not be just talked about.

Practically, then, as we see it, whatever party or parties will appeal to youth must have an active program which not only enlists the dramatic instinct of a young man but gives him some chance to make a unique personal contribution early in his experience; one which is led by a forceful, attractive leader, and where some considerable degree of prestige or success is possible early in the political experience.

Our experience has been, or we think our experience has been, that young men do better at first in small groups, nonpartisan small groups, which are interested in a simple attainable active program centered in their own community or locality, where such groups are properly led and properly advised and where it is possible to build up a very definite interest. In a word, they can be made loyal to an abstract idea if it is crystallized in a personality and in a program which has attainable objectives, which gives satisfaction and prestige in one's community, and which is definitely for the interest of the young professional engineer. Any program which will give human, emotional, or any other type of satisfaction to an individual will enlist his interest if properly and actively led.

A good example of this principle in our present day is the general policy with respect to dictatorship; crystallization in a dramatic, forceful, magnetic personality, a gospel of action, a series of recurring national emergencies, and the continual whipped-up interest which is not allowed to lag for a second.

Perhaps this picture of dictatorships on the one hand and our picture of a democracy on the other are the limiting cases. It is true perhaps that a democracy is a little sounder than we think; a little sounder than superficially seems to be true. And, it is possible, by means of a proper program and proper leadership, to do much to secure definite interest on the part of the young engineer.

A. R. CULLIMORE.[12]

[12] President of the Newark College of Engineering, Newark, N. J. Mem. A.S.M.E. and Chairman of A.S.M.E. Committee on Manual on Citizenship.

Small-Plant Management

TO THE EDITOR:

Having had some contact and part in each of the three early installations mentioned in the paper,[13] each point that Dr. Gilbreth makes invokes a wealth of interesting memories. While Taylor had retired from active practice before either the Link-Belt or Tabor installations were undertaken, the former having been carried through by Carl G. Barth with some collaboration in its earlier stages on the part of Henry L. Gantt, and the latter having been started by Mr. Barth and completed by myself, he was deeply interested and was very generous to all of us in giving us the benefit of his counsel, criticism, and guidance on the numerous occasions when he dropped in on us and during conferences at his home. Taylor attached great importance to object lessons or demonstrations and consequently regarded these models, as well as others established during those early days, as a valuable and potent means of educating industrialists, educators, and others concerned with industrial management. He also considered them of value as training schools in which men might acquire the practical experience essential to the introduction of his philosophy and technique of management in other plants. In these respects they proved eminently satisfactory.

Although previous to these installations, Taylor and his earlier associates, especially Messrs. Gantt and Barth, had developed the technique and mechanism for the application of the principles of scientific management to all departments and activities of a business, the model installations mentioned by Dr. Gilbreth did serve as laboratories in which numerous refinements were effected and complete articulation of all of the elements of scientific management was brought about. Not the least of these refinements was the Gilbreth contribution to the technique of time-and-motion study which was in part an answer to Taylor's frequently expressed hope that someone would devise a better means for the making of such studies than the stop watch.

Another point brought out by Dr. Gilbreth which cannot be overemphasized is the fact that the scheme of organization and the practices of scientific management may be readily contracted or expanded to suit the needs of industries of various sizes and that larger companies are made up of component units. In our practice of working out applications of scientific management in larger indus-

[13] "Management in the Small Plant," by Lillian M. Gilbreth, MECHANICAL ENGINEERING, August, 1939, pp. 597–598.

tries, it is usual to make the application to one individual department or unit at a time, treating it as if it were an independent business, and later bringing about the coordination of all departments or units.

Dr. Gilbreth states that during the earlier days, scientific management was largely misunderstood or not understood at all. Unfortunately today this condition still exists in too great a measure. We find too many imperfect, partial, and superficial applications of various elements of scientific-management technique and this, despite the extensive literature which exists today. There is a vital need for model installations particularly here on the West Coast where scientific management is just beginning to be understood and especially at this time throughout the entire country, in view of the revival of interest in true scientific management. This reawakening of interest has grown out of economic necessity which has been becoming more and more acute during the last several years, making the standards of management which seemed satisfactory during the postwar years quite inadequate to the demands which industry is obliged to meet today.

Important as model installations in relatively small plants may be to the extension of scientific management in its true and most effective form, we have another agency which increasingly bids fair to become an important factor. The writer has reference to the courses in scientific management being given in a number of our universities, particularly, the recent courses established at New York University under the guidance of L. P. Alford, Purdue University with which Dr. Gilbreth is associated, Stevens Institute of Technology under Dr. Dexter Kimball, and at Stanford University under Professor Paul Holden.

KING HATHAWAY.[14]

TO THE EDITOR:

One of the striking features of Dr. Gilbreth's excellent paper is its emphasis of the fact that, in management, the human element is the all-important factor. In the paper, we find no description of complicated machines, or of labor-saving devices, or of anything that displaces the human element. The only instruments mentioned are "job analyses, instruction sheets, and forms of all descriptions." These seem to occupy a very minor place in the whole scheme. On the other hand, nearly every paragraph indicates the importance of the human element. In the second paragraph, instead of machines or processes, the names of the pioneers, Taylor and Gilbreth, are mentioned. The third paragraph outlines the contributions of Lewis, Dodge, and Aldridge. The fourth begins by mentioning the treatment of the personnel. Under item 6 of the concrete example, we find that "A competent member of the organization was trained to do the work." What a world of difficulty is suggested by those two words "competent" and "trained."

An educator is amazed by the nonchalance with which the subject of choice and training of personnel is often treated. The attitude sometimes suggests that fifteen minutes should be taken off some day to train the foremen. The writer realizes that, in a paper of this length, methods of selection and education of personnel could not be developed but, even so, the importance of personnel is very well indicated.

It would be of great interest to know the extent or advisability of using aptitude, intelligence, or other psychological tests in finding competent men. Perhaps past records of performance are more dependable or perhaps an intuitive ability to pick the competent men should be depended upon. After the competent men have been found, how can they be trained? Probably the 3000 members of the Society for the Promotion of Engineering Education would have hundreds of different answers to that question. It would be interesting to have industry's answer.

GEORGE L. SULLIVAN.[15]

TO THE EDITOR:

The writer wishes to pay tribute to the Gilbreths for the tremendous contribution they have made to the management movement. It is well for the management movement that Dr. Gilbreth continues to contribute her time, ability, and experience to it.

In the paper is this very significant statement: "It is far better to spend whatever time is necessary in gathering essential data at the inception of a project, than to rush in without being properly informed and then face inevitable and costly delays while the facts are being accumulated, or perhaps make serious mistakes." The writer holds that adequate preparation is one of the most important matters in any industrial activity. A tremendous number of man-hours, equipment expense, and research effort are wasted because of improper analysis in the beginning. Such analysis should show, with respect to the subject in hand, the state of the art and, in the light thereof, what needs to be done, how it is to be done and what will be the cost of doing it. The starting point should usually be where the state of the art has left off, as disclosed by the literature on the subject. There is no more necessary and economic factor involved in management than intelligent, timely planning.

Such planning may be and should be done regardless of whether the project is a large or small one and whether it is one which may arise in a large or small organization. In fact the process of planning consists of synthesis and analysis. This process is applicable to any set of circumstances whether large or small. If thorough synthesis and analysis have been made, a proposed program can be projected with a large measure of confidence.

The writer differs somewhat with the point of view expressed by Dr. Gilbreth and Dean Kimball, as to the advantages accruing in small plants and organizations due to more intimate personnel relations which may and do obtain in such plants as contrasted with larger ones. There is a good deal of truth in the old statement that "intimacy breeds contempt." It has been my observation that small organizations and communities are not free of jealousies and frictions. Jealousies and frictions may also exist in large plants and organizations.

The author has very wisely suggested that there are similarities in the problems of large and small plants. This is true. In the last analysis, a large plant is a conglomerate of many small plants. It is only through thinking in terms of small units of organizations or plants that the managers of large outfits obtain a clear conception of what any existing situation may be and are thereby enabled to formulate the general policies necessary to bring about the real coordination and integration required for successful operation. In many respects, the small plant has distinct advantages over a larger one. Therefore it is a mistake for the managers of small plants to feel that because they are small they cannot do many of the things which are successfully carried on by larger ones. Even in the matter of research, the larger organizations often find it necessary to set up pilot plants. In these pilot plants, results of creative research are translated into practices which may be successfully transplanted in a larger chain of production. The smaller plants may be used as pilot plants, thus saving expense of constructing and operating pilot plants as the larger organizations have to do.

L. W. WALLACE.[16]

[14] Consulting Engineer, San Francisco, Calif. Mem. A.S.M.E.

[15] Dean, College of Engineering, University of Santa Clara, Santa Clara, Calif. Mem. A.S.M.E.

[16] Director, Division of Engineering, Research, Crane Co. Chicago, Ill. Mem. A.S.M.E.

A.S.M.E. BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly for the purpose of considering communications relative to the Boiler Code. Anyone desiring information on the application of the Code is requested to communicate with the Secretary of the Committee, 29 West 39th St., New York.

The procedure of the Committee in handling the cases is as follows: All inquiries must be in written form before they are accepted for consideration. Copies are sent by the Secretary of the Committee to all of the members of the Committee. The interpretation, in the form of a reply, is then prepared by the Committee and passed upon at a regular meeting of the Committee.

This interpretation is later submitted to the Council of The American Society of Mechanical Engineers for approval after which it is issued to the inquirer and also published in MECHANICAL ENGINEERING.

Following is a record of the interpretations of this Committee formulated at the meeting of October 20, 1939, which were subsequently approved by the Council of The American Society of Mechanical Engineers.

CASE No. 881

(Interpretation of Table A-6)

Inquiry: In the revision of Table A-6 recently issued to make it conform with American Standard B16e-1939, the column for flange thicknesses for 150 lb at 500 F in sizes from 1 in. to $3\frac{1}{2}$ in. covers dimensions for loose flanges only and the corresponding dimensions for the integral flanges of valves and fittings were not included. Is it permissible to make use of the differing dimensions for such integral flanges which appear in the American Standard as follows:

Nominal pipe size, in.	Thickness of integral flanges, min, in.
1	$\frac{7}{16}$
$1\frac{1}{4}$	$\frac{1}{2}$
$1\frac{1}{2}$	$\frac{9}{16}$
2	$\frac{5}{8}$
$2\frac{1}{2}$	$\frac{11}{16}$
3	$\frac{3}{4}$
$3\frac{1}{2}$	$\frac{13}{16}$

Reply: The dimensions for integral flanges of valves and fittings above given were omitted inadvertently. It was the intent that these dimensions should have been included and it is the opinion of the Committee that they should be used as a part of Table A-6.

CASE No. 882

(Interpretation of Tables P-9 and U-3)

Inquiry: Until Specification S-50 is added to Tables P-9 and U-3, will it meet the requirements of the Code to use the allowable stresses for equivalent grades of Specification S-8 which appear in these tables?

Reply: Until necessary revisions are made in Tables P-9 and U-3, allowable stresses which appear in these tables for forged steel flanges and fittings to Specification S-8 may be applied to equivalent grades made in accordance with Specification S-50. It should be noted that Par. P-299*a* limits the use of Specification S-50 to 100 lb and 300 lb standard flanges and fittings.

CASE No. 883

(Special Ruling)

Inquiry: May the plates of jacketed unfired pressure vessels, welded according to Par. U-69, carrying not over 25 lb per sq in. pressure, be stayed by welded stays applied substantially as shown in Fig. 36?

Reply: It is the opinion of the Committee that the arrangement described may be used in the construction of Code pressure vessels provided: (1) The pressure does not exceed 25 lb per sq in.; (2) the plates do not exceed $\frac{1}{2}$ in. in thickness; (3) the throats of the welds do not exceed the plate thickness; (4) the inside welds are properly inspected before the attachment of the closing plates; (5) the stresses calculated on the throat dimension of the weld do not exceed 5600 lb per sq in.; and (6) no more weld metal is deposited than is necessary to make the fillet weld. The welding operators must be qualified under Par. U-69 and stress relieving of the welds is not required.

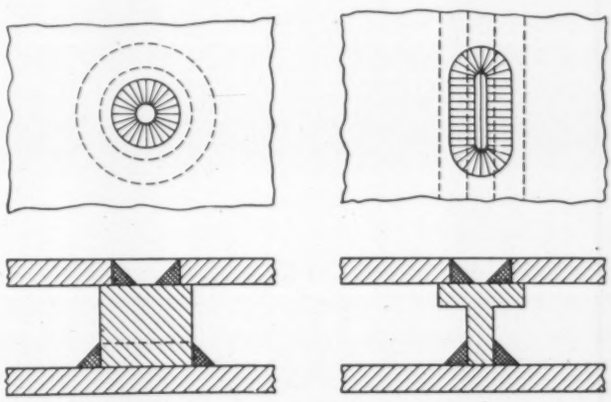


FIG. 36 USE OF PLUG AND SLOT WELDS FOR STAYING PLATES

CASE No. 884

(Special Ruling)

Inquiry: Pending action by the Boiler Code Committee in issuing final revisions of the tube tables, may the proposed revised Table P-2 and the supplementary rules published in the April, 1939, issue of MECHANICAL ENGINEERING be used in determining the required thickness of boiler tubes and waterwall tubes for pressures of 1200 lb per sq in. and over?

Reply: It is the opinion of the Committee that the proposed revised Table P-2 and the supplementary rules published in the April, 1939, issue of MECHANICAL ENGINEERING may be used under the Code rules for working pressures of 1200 lb per sq in. and over.

CASE No. 885

(Interpretation of Par. U-13g)

Inquiry: Par. U-13*g* of the Code provides for the general use of cast iron for pressure vessels. A basis is given therein for determining the thickness required when the vessel is subjected to internal pressure, but there is no basis of computation for external pressure. By what rules may cast iron vessels subject to external pressure be designed?

Reply: It is the opinion of the Committee that cylindrical pressure vessels subject to external pressure made of cast iron may be designed in accordance with the provisions of Pars. U-121, U-122, U-123, U-124, U-125, U-134, and U-135 only, but the allowable pressure shall be one half that found by these rules.

Uniformity of thickness of the walls subject to collapse shall be determined by drilling test holes, as directed by the inspector, or in such other manner as will insure accurate measurements. The thickness so determined shall be not less at any point than that used in calculating the allowable pressure.

CASE No. 886

(Interpretation of Par. U-61c)

Inquiry: Par. U-61*c* of the Code refers to heads of small diameter. Inquiry is made as to the diameters which would come within this classification?

Reply: It is the opinion of the Committee that the term "heads of small diameter" in Par. U-61*c* be interpreted as heads of 36 in. in diameter and under.

Table P-2

Table P-2. The following is a proposed revision of Table P-2 to replace that appearing in April, 1939, MECHANICAL ENGINEERING:

TABLE P-2 MAXIMUM ALLOWABLE WORKING PRESSURES* FOR SEAMLESS STEEL, LAP-WELDED STEEL, LAP-WELDED WROUGHT-IRON, AND ELECTRIC-RESISTANCE WELDED STEEL TUBES OR NIPPLES FOR WATER-TUBE BOILERS FOR DIFFERENT DIAMETERS AND GAGES OF TUBES CONFORMING TO THE REQUIREMENTS OF SPECIFICATIONS S-17, S-40, AND S-32

Size Outside Diameter, In.		1/2	3/4	1	1-1/8	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	3	3-1/4	3-1/2	3-3/4	4	4-1/2	5	
Wall Thickness In.	Nearest Bwg No.																			Wall Thickness In.
0.055	17-	330	120																	0.055
0.065	16	740	390	220	160	120														0.065
0.075	15+	1150	670	430	350	280	190													0.075
0.085	14+	1570	950	640	530	450	330	240	170											0.085
0.095	13	I 1980	1220	840	720	620	460	360	270	210	160	120								0.095
0.105	12-		1500	1050	900	780	600	470	380	300	240	190	150							0.105
0.120	11		1910	1360	1180	1030	810	650	530	440	370	310	260	210	180	150				0.120
0.135	10+			1670	1450	1280	1020	830	690	580	490	420	360	310	270	230	200			0.135
0.150	9+	II		1980	1730	1530	1220	1010	840	720	620	530	460	410	360	310	270	210	160	0.150
0.165	8				2000	1770	1430	1180	1000	850	740	650	570	500	440	390	350	280	220	0.165
0.180	7					2020	1640	1360	1150	990	860	760	670	600	530	480	430	350	280	0.180
0.200	6-	III					1910	1600	1360	1180	1030	910	810	720	650	590	530	440	370	0.200
0.220	5							1830	1570	1360	1200	1060	950	850	770	700	640	530	450	0.220
0.240	4+							2070	1770	1540	1360	1210	1080	980	890	810	740	620	530	0.240
0.260	3+								1980	1730	1530	1360	1220	1110	1010	920	840	720	620	0.260
0.280	2-									1910	1690	1510	1360	1230	1120	1030	950	810	700	0.280
0.300	1									2100	1860	1660	1500	1360	1240	1140	1050	900	780	0.300
0.320											2020	1810	1640	1490	1360	1250	1150	990	860	0.320
0.340												1960	1770	1620	1480	1360	1260	1080	950	0.340
0.360													1910	1740	1600	1470	1360	1180	1030	0.360
0.380													2050	1870	1720	1580	1460	1270	1110	0.380
0.400														2000	1830	1690	1570	1360	1200	0.400
0.420															1950	1800	1670	1450	1280	0.420
0.440															2070	1910	1770	1540	1360	0.440
0.460																2020	1880	1640	1440	0.460
0.480																	1980	1730	1530	0.480
0.500																	2090	1820	1610	0.500

*NOTE: These values have been increased to the next higher unit of 10 where the actual values exceed an even unit of 10.

FORMULAS

[A] $$P = \frac{20700\,(t - 0.04)}{D} - 300$$

[B] $$P = \frac{27600\,(t - 0.04)}{D} - 400$$

These formulas are derived from the general formula:

$$P = \frac{2.3\,S\,(t - 0.04)}{D} - \frac{S}{30}$$

By substituting the value of 9000 for S in formula [A] and 12000 in formula [B]

where

P = maximum allowable working pressure, lb per sq in.,
S = maximum allowable stress, lb per sq in. (Table P-6),
t = thickness of tube wall, in.,
D = outside diameter of tube, in.

Notes on Table P-2

1 For pressures higher than those given in the table, the allowable working pressure shall be the next higher units of ten above the values given by formula [A] from which all the values in the table are calculated for seamless steel, tubes, complying with Specifications S-17 and S-40. Table P-2 and formula [A] shall be used for wrought iron, lap-welded steel, and electric-resistance welded tubes, grades A and B, within the limitations given in paragraphs 2 and 3 of these notes.

2 No tube shall be allowed a working pressure in excess of that permitted by formula [C], with the value of S taken from Table P-6, for the material from which the tubes are made, at a temperature not less than the maximum mean wall temperature of the tube, but not less than a temperature of 750 F. For this purpose the mean wall temperature is defined as the average temperature of the inside and outside tube surface which is expected to exist at the point of maximum tube temperature.

[C] $$P = \frac{2.3\,S\,t}{D} - \frac{S}{30}$$

3 The horizontal stepped lines marked I, II, and III indicate the limit of thickness for which Table P-2 is applicable for various classes of tubes up to a temperature of 750 F. For thicknesses below these lines formula [C] will apply, provided the mean tube temperature does not exceed 750 F. The line marked I is the limit for lap-welded wrought iron tubes. The line marked II is the limit for lap-welded steel tubes. The line marked III is the limit for electric-resistance welded steel tubes. For temperatures higher than 750 F these limit lines will occur at lesser thicknesses.

4 For higher tensile strength tubes, such as those complying with Specifications S-49, S-48, and S-32, grade C, formula [B] shall be used with the limitations given in paragraph 2 of these notes.

5 Formula [C] may be used for determining the maximum allowable pressures for seamless steel tubes for forced-circulation water-tube boilers within the limitations of paragraph 2 of these notes.

6 The minimum thickness for tubes for water-tube boilers, where the tubes are expanded into drums or headers, shall be as indicated in Table P-2, for the minimum pressures shown for each diameter.

Table P-6

TABLE P-6. It is proposed to revise this table by making the values of "S" for tube materials made from open or rimmed steel, the same as for killed steel, with a minimum silicon of 0.10 per cent at the temperature of 750 F. This would require that the value of 8100 for Specification S-17, grade A, nonkilled steel, be increased to 8600; that the value of 6900 for Specification S-32, grade A, nonkilled steel, electric-resistance welded tubes be increased to 7300; and that the value of 8450 for Specification S-32, grade C, electric-resistance welded tubes, nonkilled steel, be increased to 8850.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

A.S.M.E. Manual on Cutting of Metals

MANUAL ON CUTTING OF METALS—SINGLE-POINT LATHE TOOLS. By A.S.M.E. Committee on Metal Cutting Data. The American Society of Mechanical Engineers, New York, N. Y., 1939. Fabrikoid, 5 1/2 × 8 3/8 in., 319 pp., 36 figs., $5.

REVIEWED BY R. E. W. HARRISON[1]

METAL cutting down through the ages always was referred to as an art. Its transition to an exact science did not take place until Barth translated the art with the aid of his mathematics. From thence onward the practice became an exact science. To refer to it today as an art is a mistake which automatically depreciates the most fundamental tool of the speed and feed men in the modern production organization. Let us assume then that, given an adequate knowledge of the subject, those of us who earn our daily bread by the manipulation of metals can count on the existence of a standard work of reference, which if nothing else, consolidates the statement in a citadel of truth, i.e., the exact science of cutting metals.

The "Manual on Cutting of Metals" prepared by the A.S.M.E. Committee on Metal Cutting Data has evidently been produced with several objectives in mind. Obviously, the primary objective has been to provide in a form of maximum accessibility and simplicity the basic data relating to the art of cutting metals.

The diversification of presentation makes the work of equal value to the foreman in the machine shop, looking for the data which will enable him to discuss his practices intelligently with the management speed and feed man, as well as to the designer of machine tools, who must provide power and speed to take the utmost advantage of modern metal-cutting tools and the inherent resistance to punishment possessed by the work contemplated on the machine. To each of these two classes of users might be added the teachers dealing with their respective subjects in trade training schools, and the engineering branches of colleges.

The outstanding feature of the book is its practical usability. One hundred and sixty-three pages are devoted to tables showing the cutting speeds that can be utilized with many different types of steel and with various forms of cutting tools for depths of cut ranging from 0.002 in. to 1/8 in. The metals listed in these tables cover all of the steels and cast irons commonly used in industry, including a wide range of carbon steels, chrome-molybdenum-nickel steels, chrome-molybdenum steels, chrome-nickel steels, chrome-vanadium steels, chromium steels, manganese steels, nickel-molybdenum steels, and free-cutting steels. In addition there is a table of machinability constants which enables the user of the book to determine cutting speeds and horsepower for 26 different grades of cast iron. Another set of tables permits the determination of feeds and speeds for 34 nonferrous metals, including brass, bronze, monel metal, aluminum, copper, hard rubber, bakelite, and slate. Supplementing these tables are others which give multipliers for use when there are variations from the standard conditions shown by the table as, for example, effect of changes in the tool materials, in the hardening and tempering temperatures, changes in rake angles, and in the use of cutting fluids.

The use of the tables is explained by typical examples of their application to actual shop jobs with various materials and under various conditions. For instance, one example is on page 82, which shows how the tables may be used in rate setting to determine the feeds, speeds, and machine time to turn a piece of bar stock to two diameters for final grinding, with a sharp corner at the junction of the two diameters, in a 3 1/2-in. hand screw machine. Detailed instructions are given in the compilation of special shop tables to adapt the data to the conditions that may exist in any given shop.

Many of the data in the book have been tested by their application to work under commercial conditions. In one case that has come under the writer's observation it was found practicable to increase speeds and feeds to a point that represented a decrease in machine time of well over ten per cent in an already efficient shop. In this same shop a certain class of work had given much trouble because of chatter. Application of the principles developed in the Committee's study of chatter as set forth in the book completely eliminated chatter and permitted an increase in cutting speeds of approximately fifty per cent.

The book is divided into three parts. Part 2 comprises tables which have been discussed in the foregoing. This is the part that will interest the shopman the most. By shopman we mean not only the man at the machine who can, with profit, take the book home with him and study it at night, but also the foreman, the superintendent, the time-study man, the rate setter, and also, in many instances, the chief executive as well. These latter can use the book as a means of check-up on the performance in their own establishments.

Part 1 of the book comprises in some detail the factors that influence the cutting of metals. In it are discussions of tool shapes and performance, with drawings of the tool shapes that the experimental work of the Committee showed to be most efficient. Some of these shapes will appear rather startling to the mechanic, who more or less subscribes to the conventions in tool forms. Notwithstanding this, the application of these shapes in more than one shop has demonstrated that they are capable of much more efficient work than some of the more conventional tool forms.

Part 3 of the book is somewhat mathematical and will be scrapped by the average shopman. Nevertheless, the data therein are of considerable service to the research man and the rate setter.

Not the least valuable portions of the book are the very extensive bibliography of the literature on metal cutting and a most complete index which enables the user to find instantly the particular table relating to the metal-cutting problem that he has on hand.

All in all it is difficult to see how the shelf of reference books possessed by any qualified machine-shop foreman, machine-tool designer, or metal-cutting research engineer, could be regarded as complete without this very valuable record of the progress which has been recorded in metal cutting to date.

[1] Clarke-Harrison, Inc., Philadelphia, Pa. Mem. A.S.M.E.

Graphic Presentation

GRAPHIC PRESENTATION. By Willard C. Brinton. Brinton Associates, New York, 1939. Fabrikoid, 6 × 9 in., 511 pp., $5.

REVIEWED BY H. L. SEWARD[1]

THIS vivid display of charts of such great diversity and the many novelties in technique form a very interesting and modern means of expression which are explained by the caption of the introduction as "Magic in Graphs." All of the sixty chapters have so many illustrations and require so little explanation and definition that the use of figure numbers is abandoned. Pertinent comment and definition are made in close proximity to the displays. The charts are most interesting in themselves, even if one were not concerned with the construction or use of such charts. There is a slight salty flavor because of several nautically minded charts. The unique grouping and the ingenious designation of many types of charts tend to give the reader some new ideas in the display of quantities or comparative relationships.

The preparation of this book must have constituted a real task in the organizing of such a great quantity of illustrative material. This part of the task has been well done and accounts for the introduction of so many new names of types of charts. The emphasis on the use of color is interesting, timely, and often novel.

There is a generous inclusion of references, even to competitive volumes and proprietary articles in most chapters.

As the author of a book in the field of graphic methods published twenty-five years ago, Mr. Brinton should be credited with another accomplishment in bringing out the current volume which is useful and attractive. His experience and ingenuity permit him to include many suggestions or stunts in the book which will appeal to those who need just a hint to devise a different or a better chart. Practical suggestions on the producing and reproducing of charts, the use of color, selection of paper, binding, exhibits of charts, as well as on the use of the camera, lantern slides, and models, all profusely illustrated, are followed by a glossary of terms. One cannot assume that everybody is thoroughly impressed by or can learn from seeing a chart. Occasionally one still meets a stony-eyed banker or a local alderman who should have a column of figures instead of a chart. For those who are more fortunately equipped, this book is very stimulating. The buoyant tone of this tome could be described aptly by reference to one illustration in the chapter "Quantitative Cartoons" which gives another definition of the "efficiency expert." Here one sees the attention of a dissident dean being drawn to something on the office wall which appears to be a graph making very satisfactory but jagged progress from lower left to upper right, but one notes that the professor explains it by saying "It's only a crack in the wall, but it looked so good I had a frame put around it."

[1] Professor of Mechanical Engineering, Yale University, New Haven, Conn. Mem. A.S.M.E.

Books Received in Library

A B C OF AVIATION. By V. W. Pagé. Revised and enlarged edition. Norman W. Henley Publishing Co., New York, N. Y., 1939. Cloth, 5 × 8 in., 418 pp., illus., diagrams, tables, $2.50. This is a simple account of aviation, popular in tone and intended for the beginner. The different types of aircraft and their design and construction are explained, engines and propellers are described, and a chapter is devoted to flying methods. Other chapters discuss instruments and instrument flying, and inspection.

AIRCRAFT YEAR BOOK FOR 1939. Twenty-first edition, Aeronautical Chamber of Commerce of America, New York, N. Y., 1939. Cloth, 6 × 9 in., 580 pp., illus., diagrams, maps, tables, $5. This annual provides a record of developments in aviation during the last year, both at home and abroad. The work of the Army and Navy, the activities of the various Federal agencies, and commercial firms are reviewed. Chapters are devoted to notable flights, to air lines, private flying, airports, to novelties, and other fields of interest. The book includes tables of aircraft specifications, descriptions of aircraft and engine designs, a chronology of events and records, an aeronautical directory, and statistics of the industry.

AMERICAN DIESEL ENGINES. By L. H. Morrison. Second edition, McGraw-Hill Book Co., New York, N. Y., and London, England, 1939. Cloth, 6 × 9½ in., 489 pp., illus., diagrams, charts, tables, $5. This work is planned to give the factory executive and operating engineer the information that will enable them to select the best engine for their purpose, and operate and maintain it efficiently. It includes detailed descriptions of all American-made engines. The new edition has been revised extensively.

BOECKH'S MANUAL OF APPRAISALS. By E. H. Boeckh. Third edition, enlarged and revised, Rough Notes Co., Indianapolis, Ind., 1937. Leather, 6 × 9 in., 399 pp., illus., diagrams, charts, tables, $6 for manual; $9.50 for manual and tables. The opening section describes briefly appraisal systems, the Boeckh index control for local cost figures, and the practical use of the manual. Part 2 gives structural base costs for more than a hundred types of buildings; part 3 discusses appraisal analysis; and part 4 is concerned with land valuation. Tax information, building nomenclature, and construction requirements are appended.

BUSINESS CYCLES. 2 Volumes. By J. A. Schumpeter. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1939. Cloth, 6 × 9 in., 1095 pp., charts, $10. An analysis of the causes and the mechanism of business cycles is presented, together with a detailed discussion of statistical and historical material covering the last 150 years. These materials are so arranged as to form a series of exercises in the diagnosis of business situations, and to introduce students and businessmen to the viewpoints and methods relevant to the problems of the day.

CAST-IRON PIPE. By P. Longmuir. J. B. Lippincott Co., Philadelphia, Pa., 1939. Cloth, 5 × 8 in., 104 pp., illus., diagrams, tables, $2. The manufacture and properties of cast-iron pipe are briefly described, with special reference to the centrifugal casting process. Pipe joints and methods of metallurgical control are also discussed. The book is a welcome addition to the scanty literature on pipe making.

CHEMICAL ENGINEERING CATALOG 1939, 24th edition. Reinhold Publishing Corporation, New York, N. Y. Cloth, 8 × 11 in., 1026 pp., illus., diagrams, charts, tables, $3. This catalog provides a comprehensive directory of manufacturers of chemicals, raw materials, equipment machinery, and supplies used in the chemical industries and laboratories. Data supplied by dealers and makers are carefully indexed by subject so that reference is easy. In addition there is an extensive catalog of technical books. The volume is a useful guide for purchasing agents and others.

CONSTRUCTION OF NOMOGRAPHIC CHARTS. By F. T. Mavis. International Textbook Co., Scranton, Pa., 1939. Fabricoid, 5 × 8½ in., 132 pp., diagrams, charts, tables, $2. This textbook provides a practical course for engineers and advanced undergraduate students. The theory of logarithms, the slide rule, and functional coordinate papers are discussed. Many examples of nomogram construction are included.

ENGINEERING MATERIALS. By A. H. White. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1939. Cloth, 6 × 9 in., 547 pp., illus., diagrams, charts, tables, $4.50. The greater part of this book is devoted to the manufacture, heat-treatment, fabrication, and properties of iron, steel, and the nonferrous metals, with consideration of the effect of methods of fabrication on the physical properties. Subsequent chapters present information on clay products, lime and cements, fuels, water and its industrial utilization, corrosion and protective coatings, and plastics. References accompany each chapter.

DIE ENTROPIE. By W. Büttner. V.D.I. Verlag, Berlin, Germany, 1939. Paper, 6 × 8 in., 131 pp., diagrams, charts, tables, 9 rm. The physical fundamentals, including a statement of the law, description of processes, and thermodynamical and mathematical derivations, precede the section on technical applications. These applications are in the fields of steam and internal-combustion engines, compressors, and refrigeration. Entropy diagrams for solid bodies are discussed briefly.

FAHRZEUG-DIESEL-MOTOREN UND FAHRZEUG-GAS-GENERATOREN im Wirkungsweise, Bau Betrieb und Anwendung. By H. Fiebelkorn. Second edition enlarged, Union Deutsche Verlagsgesellschaft Roth & Co., Berlin, Germany, 1938. Cloth, 7 × 10 in., 285 pp., illus., diagrams, charts, tables, 20 rm. The major portion of this book is devoted to the theory, operation, construction, injection equipment, etc., of Diesel engines. Troubles and their remedies are discussed, and there is a chapter on fuels and lubrication. The remainder of the text deals with various types of German wood-gas producers for motor vehicles. Data are tabulated concerning German Diesel engines

and equipment, and there is a ready-reference section on Diesel-engine and gas-producer troubles, arranged by symptoms.

GRAPHIC PRESENTATION. By W. C. Brinton. Brinton Associates, New York, N. Y., 1939. Fabricoid, 6 × 9½ in., 512 pp., illus., diagrams, charts, tables, $5. A brief encyclopedia of methods for representing facts graphically, which covers a wide range: maps, geneological charts, statistical charts, etc. Each variety is represented by specimens, with explanations of their uses and interpretation. The use of color is covered. In addition practical advice is given on equipment and methods for making graphs and exhibits, on reproduction, and on the use of graphic material. There is a short glossary.

INDUSTRIAL STATISTICS CONFERENCE, PROCEEDINGS, held at Massachusetts Institute of Technology, Cambridge, Mass., Sept. 8–9, 1938. Pitman Publishing Corporation, New York, N. Y., and Chicago, Ill., 1939. Paper, 6 × 9 in., 315 pp., diagrams, charts, tables, $2.50. This conference, held at the Massachusetts Institute of Technology in 1938, was devoted to a discussion of the application of statistics to the control of quality and industrial standardization. The papers presented show some of the industrial fields where statistical methods have been used, describe some types of statistical tools which are useful, and consider a few practical problems in special fields.

INTERNAL COMBUSTION ENGINES. By L. C. Lichty. Fifth edition. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1939. Cloth, 6 × 9 in., 603 pp., illus., diagrams, charts, tables, $4.50. In this edition of this well-known textbook, the name of Robert L. Streeter disappears from the title page and Professor Lichty assumes full authorship. The work first develops the theoretical principles and then illustrates their application to the analysis, design, and operation of the internal-combustion engine and its parts. Changes include a simplification of the method of analyzing thermodynamic processes, a chapter on air-standard cycle analysis, revision of the chapters on fuels, detonation and fuel injection, more material on combustion-chamber design and air cooling, and thorough revision throughout.

INTRODUCTION TO THE STUDY OF HEAT-TREATMENT OF METALLURGICAL PRODUCTS. By A. Portevin. Penton Publishing Co., Cleveland, Ohio, 1939. Cloth, 6 × 9 in., 246 pp., diagrams, charts, tables, $5. The major part of the book is devoted to the transformation points, hardening, quenching, tempering, and annealing of steel. A supplementary chapter of experiments and examples follows each chapter of text. Malleabilization of cast irons, heat-treatment of light aluminum alloys, and some general remarks on heat-treatment are also included.

IRON BREW, a Century of American Ore and Steel. By S. H. Holbrook. The Macmillan Co., Inc., New York, N. Y., 1939. Cloth, 6 × 9 in., 352 pp., $2.50. This book, vivacious, anecdotal, and readable tells the story of the discovery and development of the ore regions of the Great Lakes, and of the expansion of the steel industry that followed. It is a useful addition to the history of iron and steel.

JOHNSON'S MATERIALS OF CONSTRUCTION. By the late J. B. Johnson, rewritten by M. O. Withey and J. Aston. Eighth edition, rewritten and revised. John Wiley & Sons, Inc., New York, N. Y., 1939. Cloth, 6 × 9½ in., 867 pp., illus., diagrams, charts, tables, $6. This standard work has again been extensively revised in accordance with present-day practice. Essential information is presented concerning the sources, manufacture, and fabrication of the principal materials; selected data are given covering the more important mechanical and physical properties and the influence of various factors upon these properties; the causes of defects and variations are shown, with methods for their discovery; the technique of testing materials is considered; and some of the more general uses of the different materials are given.

LABORATORY MANUAL prepared for Course M.E. 110. By R. G. Folsom and E. H. Taylor. University of California, Department of Mechanical Engineering, Fluid Mechanics Laboratory, Berkeley, Calif., 1939. Paper, manifold copy, 9 × 11 in., 40 pp., diagrams, charts, tables, $1.35. This book describes an elementary course in experimental fluid mechanics, with directions for the experiments. There are three main sections: A brief review of the fundamentals of fluid mechanics, general instructions in laboratory procedure, and descriptions of specific experiments.

MACRAE'S BLUE BOOK. 47th Annual Edition, 1939–1940. MacRae's Blue Book Co., New York, N. Y. Cloth, 8 × 11 in., 3616 pp., illus., $15. The forty-seventh annual issue, while subject to the customary revision of the information, follows the established pattern. It provides an index of manufacturers and wholesalers and their local distributors, with addresses; a carefully indexed classified list of manufacturers; a directory of commercial bodies, banks, railroads and warehouses in towns of 1000 or more population, and a list of trade names.

MACHINE DESIGN. By V. L. Maleev. International Textbook Co., Scranton, Pa., 1939. Cloth, 6 × 9½ in., 579 pp., diagrams, charts, tables, $4.50. The importance of localized stress concentration and fatigue failure in methods of analysis and procedure in machine design is emphasized, and the application of new data of this sort in present-day design is demonstrated. The first few chapters cover general considerations of stresses and materials. Succeeding chapters are devoted to the design of various basic machine parts. There is a large group of problems appended.

MATERIALS OF CONSTRUCTION. By the late A. P. Mills. Fifth edition, rewritten and edited by L. F. Rader. John Wiley & Sons, Inc., New York, 1939. Cloth, 6 × 9 in., 564 pp., illus., diagrams, charts, tables, $4. This general textbook covering the manufacture, properties, and uses of the common materials of engineering construction has been revised and enlarged to include new chapters on the properties of materials and to present information on certain materials not previously covered. Of particular importance is the new section on organic materials, such as protective coatings and plastics.

METALL-TECHNISCHES TASCHENBUCH. By W. Guertler. Johann Ambrosius Barth, Leipzig, 1939. Paper and bound, 6 × 8 in., 370 pp., illus., diagrams, charts, tables, 48 rm.; bound, 50 rm. This comprehensive handbook describes the properties and structure of metals and industrial alloys, and provides a profusion of tables and eutectic diagrams. The melting, heat-treatment, welding, temperature measurement, metallography, and testing of metals are discussed, with description of the necessary equipment. There are tables of useful data, indexes listing metals and alloys by composition and trade name, and a group of sample photomicrographs.

MITTEILUNGEN DES INSTITUTS FÜR STRÖMUNGSMASCHINEN DER TECHNISCHEN HOCHSCHULE KARLSRUHE. Edited by W. Spannhake. Heft 4, V.D.I. Verlag, Berlin, 1939. Paper, 8 × 12 in., 128 pp., illus., diagrams, charts, tables, 4 rm. The first two articles in this communication deal respectively with the investigation of the flow through and the measurement of the pressure on the rotor wheel of a propeller-type turbine. The final article describes an investigation of the flow produced by a fixed airscrew.

MOTOR DICTIONARY, a Complete Dictionary of Motor Terms in Three Languages. Part II, English-French-German, compiled by B. R. Dierfeld. Second enlarged edition. Massie Publishing Co., London; Chemical Publishing Co., New York, N. Y., 1938. Cloth, 6 × 10 in., 261 pp., $4. Phrases as well as words are included in this comprehensive three-language dictionary of motor terms. The present section, part 2, is alphabetized by the English words, with the corresponding French and German terms added. The revised edition has been enlarged to cover front-wheel drive, independent wheel suspension, the Diesel engine, solid and gaseous fuels, and many recent improvements as well as innovations in equipment.

TEXAS OIL AND GAS SINCE 1543. By C. A. Warner. Gulf Publishing Co., Houston, Texas, 1939. Cloth, 6 × 9 in., 487 pp., illus., charts, maps, tables, $5. In the first chapter is set forth the general history of the oil and gas industry in the territory now included in the state of Texas. Chapter 2 discusses the economic importance and growth of the industry, and chapter 3 describes the general stratigraphy and geologic structure. The succeeding six chapters are devoted, respectively, to each of the six major producing regions. Historical documents and records, production statistics, and a selected bibliography appear in the two final chapters.

THEORY AND USE OF THE COMPLEX VARIABLE. By S. L. Green. Pitman Publishing Corporation, New York, N. Y., and Chicago, Ill., 1939. Cloth, 6 × 9 in., 136 pp., diagrams, $3. An introductory account of the subject of the complex variable and conformal transformation, with some indication of applications to problems of mathematical physics, aeronautics, and electrical engineering. The mathematical requirements comprise some knowledge of calculus and analytical plane geometry. Exercises are included.

WERKZEUGE UND PRESSEN DER STANZEREI. Teil I: Werkzeuge zum Schneiden, Biegen, und Ziehen. By E. Göhre. Second edition, revised. V.D.I. Verlag, Berlin, Germany, 1939. Paper, 6 × 8 in., 60 pp. text, 112 pp. tables, illus., diagrams, charts, 8 rm. This book is intended for the press operator. It contains a wealth of practical information upon the design, construction, and use of punches, dies, and other press tools for cutting, bending, and drawing sheet metal, accompanied by over three hundred photographs and drawings. Special attention is given to economy of material.

WHO GETS THE MONEY? By W. Rautenstrauch. Revised edition. Harper & Brothers, New York, N. Y., and London, England, 1939. Cloth, 6 × 8 in., 122 pp., charts, $1.50. In connection with an analysis of how the national income is spent, to whom it goes, and how it is used, proposals are made for a fuller application of productive capacity to the problem of feeding, clothing, and housing the 130,000,000 citizens of the United States.

A.S.M.E. NEWS

And Notes on Other Engineering Activities

Engineering Youth Has Its Day at 60th Annual Meeting of the A.S.M.E., Dec. 4–8, 1939

Special Session, Juniors' and Students' Luncheon, and Presidential Address Stress Needs of Young Engineers

THE YOUNG ENGINEER finally came into his own on Wednesday, Dec. 6, when The American Society of Mechanical Engineers dedicated that day to him on its program for the 60th Annual Meeting, which took place in Philadelphia during the week of Dec. 4–8. A special session in the morning, a Juniors' and Students' luncheon attended by prominent engineers, the awards of a medal and prizes to Junior members, and the Presidential Address in the evening at the Annual Dinner indicated, more than ever, the great attention which is being directed today toward the student and junior engineers and their professional and economic problems. More than 300 student members and the same number of Juniors attended one or more of the functions planned for them that day, including the various inspection trips to industrial plants in Philadelphia and vicinity.

THE A.S.M.E. IS WELCOMED WITH LIGHTS ON PHILADELPHIA'S CITY HALL

Special Session

With Dean John A. Goff presiding and A. H. Repscha acting as recorder, the Juniors' and students' special session was opened by Zachary Wobensmith, as representative of the Philadelphia Junior Group, with an interesting discourse about a few points that engineers should know about patents and the patent system. He was followed by Leslie F. Zsuffa, representative of the Metropolitan Junior Group, who brought out the many problems faced by the young engineer and how some of these can and are being solved. In conclusion, a very inspiring address was delivered by Hamilton R. Disston, vice-president, L. H. Gilmer Co., on the topic of "Our Industrial Destiny." Mr. Disston showed how the future of American industry depended upon the engineer because of his strategic position between labor and management. More than 75 students and engineers attended this session.

Juniors' and Students' Luncheon

About 225 students, Juniors, and outstanding members of the Society attended the luncheon on Wednesday. Before and during the serving of the food, the students and younger members talked about all phases of mechanical engineering with the prominent engineers who were seated at the various tables in the room. With a good meal tucked under their belts, the boys leaned back in their chairs and heard the toastmaster, Prof. F. V. Larkin, chairman of the Committee on Relations With Colleges, introduce the ones seated at the head table. These included C. E. Davies, secretary of the Society; David T. James, 1939 Undergraduate Student Award winner; C. C. Jones; Dr. Harvey N. Davis, past-president A.S.M.E.; John I. Yellott, Jr., Junior A.S.M.E. and recipient of the Pi Tau Sigma Medal for 1939; President A. G. Christie; President-Elect Warren H. McBryde; Wilfrid E. Johnson, recipient of the 1938 Pi Tau Sigma Medal; Prof. H. E. Degler, secretary of Pi Tau Sigma; James R. Bright, recipient of the 1939 Charles T. Main Award; Harte Cooke, chairman of the Board of Honors and Awards and of the Old Guard; L. Austin Wright, secretary of the Engineering Institute of Canada; and Dean John A. Goff.

ANNUAL MEETING SIDELIGHT

(William B. Burlingame, Exeter, N. H. (left), tells Col. E. H. Whitlock about his bringing Carl Brewer, a high-school student (center), to the Meeting as his guest. "I don't know if I'm going to be an engineer or not," said Carl, but I am having a lot of fun except for a little bit of homesickness.")

Upon being introduced as "the most outstanding young mechanical engineer of 1939" by President Christie, John I. Yellott, Jr., made a novel response by presenting, for the first time in public, slides showing the formation of ice on tubes held in flowing steam. These results were achieved in a research project he is conducting at Stevens Institute for a pump manufacturer. This was followed by the introduction of Mr. James and Mr. Bright, the student-award recipients.

In a short address, President Christie stated that much can be learned by the graduate engineer outside of college. He stated that there is a greater opportunity for American engineers today since the war has closed the technical schools of Europe. In talking about post-graduate training of engineers, he said that this had so engaged his attention that his Presidental Address, at the Annual Dinner that evening (see page 5) concerned itself

entirely with this subject. President Christie concluded by saying, "Let us make America the engineering leader of the world."

In acknowledging his introduction, President-Elect McBryde responded by telling those present that the engineering profession is "no better or worse than you young men can make it. . . . it is possible for you to carry the Society on to greater heights than yet achieved, not only in this country but also in the world."

Students Guests at Annual Dinner

The Old Guard, a group of members who have been in the Society for 35 years or more and are thereby exempt from further dues, have collected a fund from which the expenses to, during, and from the Annual Meeting, are paid each year for all recipients of student awards. Furthermore, all representatives of Student Branches at the Annual Meeting are the guests of the Old Guard at the Annual Dinner. At the Philadelphia Meeting, the student guests included Mr. Bright, Mr. James, and a score of student representatives.

C. H. Dolan Now Heads Aeronautic Division

C. H. DOLAN

C. H. DOLAN, prominent World War aviator as a member of the Lafayette Escadrille, and member A.S.M.E., has been made chairman of the A.S.M.E. Aeronautic Division for 1940. Mr. Dolan is especially fitted for this position because of more than 25 years' experience in the aeronautical field. Besides having been vice-president and operations manager for Eastern Air Lines, Inc., in the early part of the decade, he was also a consulting air-transport engineer and made many surveys for the U. S. Government. In his present position as vice-president and American manager of The Intercontinent Corporation, he has assisted in building an aircraft factory and maintenance plant in China.

A.S.M.E. Calendar

of Coming Meetings

May 1–3, 1940
Spring Meeting
Worcester, Mass.

June 17–21, 1940
Semi-Annual Meeting
Milwaukee, Wis.

September 3–6, 1940
Fall Meeting
Spokane, Wash.

(*For coming meetings of other organizations see page 18 of the advertising section of this issue*)

AT THE SMOKER

(R. E. Flanders and Wallace Clark lean over to hear Dean Kimball's story while the others wish they were closer.)

Get-Together Smoker New Feature at A.S.M.E. Annual Meeting

Real Man's Food, Rip-Snorting Western Movies, Beer and Fast-Moving Vaudeville Acts Provided

A NEW FEATURE at an Annual Meeting of The American Society of Mechanical Engineers was introduced at the 1939 function in Philadelphia, when 650 members of the Society attended a "Get-Together Smoker" on Tuesday evening, Dec. 5, in the main ballroom of The Bellevue-Stratford. Starting at 6:30 in the evening, a long line soon formed outside the doors to the ballroom as the members slowly filed into the room and along a long table laden with man's food, including fried oysters and clams, roast beef, potato salad with plenty of onions, tangy coleslaw, thick slices of rye bread, crunchy rolls, and gallons of deep-brown coffee, all planned and arranged by Joseph F. Bennett, 3rd. The boys then proceeded to tables covered with red-checkered table cloths and having on them glasses and pitchers containing the products of Philadelphia brewers. While the members were eating, Victor L. Sanderson, Philadelphia member of the A.S.M.E., led them in singing such songs as "Sweet Adeline," "Moonlight and Roses," and "The A.S.M.E.'s Are Here," the words of which are as follows:

Ho—This is Philadelphia's meeting,
Ho—It's time for happy greeting.
So—It means the A.S.M.E.'s are here,
Ho—Let's give a rousing good cheer,
Ho—We will prove that we're good fellows.
So—As the evening grows and mellows,
We'll forget all stresses and strains, and sing
our joyous refrains,
As pleasure reigns.

Sound Movies

After the eats, the room was darkened and several reels of sound movies showing cowboys in action at rodeos, boxers fighting, and wrestlers slugging were shown to an appreciative audience. It made many a man in the audience glad that he lives the quiet life of an engineer. This part of the program was concluded with some more singing on the part of the boys led again by Vic Sanderson.

Vaudeville Acts

Vaudeville acts, once seen in almost every theater in the land, have disappeared in recent years. So, all the more credit is due to the Smoker Committee, headed by H. M. Wilson, for the fine series of high-caliber acts which it collected and presented for the edification of the engineers. Each act, whether singing, comedy, dancing, or novelty, proved to be the best in its field. Particularly good were the pair dancing on stilts, the accordion player with the bushy hair, the master of ceremonies and his jokes, and the various singing and dancing artists. Noteworthy was the fact that everyone, young or old, liked the acts and enjoyed himself tremendously.

Door Prizes

During an intermission between the acts, Mr. Wilson, assisted by Robert Peterson and two girls from one of the acts, picked tickets from a basket and awarded to the holders

of the lucky numbers such door prizes as radios, toasters, hats, paper knives, and even a water softener. These prizes were donated by the H. M. Wilson Co., Westinghouse Electric & Manufacturing Co., General Electric Co., United Engineers and Constructors Corporation, Philadelphia Electric Co., Riley Stoker Co., and the Permutit Co.

Dr. C. B. Millikan Presents Wright Brothers Lecture

ON THE 36th anniversary of the first flights of the Wright Brothers at Kitty Hawk in 1903, Dr. Clark B. Millikan, associate professor of aeronautics, California Institute of Technology, presented the Third Wright Brothers Lecture of the Institute of Aeronautical Sciences.

In his talk, which was given on Saturday afternoon, Dec. 16, at Columbia University, Dr. Millikan discussed the importance of "power on" effects in connection with modern airplanes and described a laboratory installation developed to make possible the determination of such effects during routine wind-tunnel tests. The special operating conditions required for the efficient execution of such investigations were analyzed in detail. Finally, a sytematic method of estimating the effects of power on static longitudinal stability was presented.

D. W. Douglas Is Awarded 1939 Guggenheim Medal

THE Daniel Guggenheim Medal for 1939 has been awarded to Donald Wills Douglas, president of the Douglas Aircraft Company of Santa Monica, California, it was announced recently by Dr. George W. Lewis, chairman of the Board of Award. The medal, which is to be presented at the Honors Night banquet of

D. W. DOUGLAS

the Institute of the Aeronautical Sciences on January 26, 1940, is given to Mr. Douglas "for outstanding contributions to the design and construction of transport airplanes."

Mr. Douglas is an honorary fellow and past-president of the Institute of the Aeronautical Sciences. He received the Collier Trophy for 1935 in recognition of his development of twin-engined commercial transport airplanes. The same year he delivered the Wilbur Wright Memorial Lecture, in London, of the Royal Aeronautical Society.

HAPPINESS REIGNS AT THE SMOKER

(*Left to right:* President-Elect Warren H. McBryde, C. Harold Berry, and President A. G. Christie.)

At the meeting which confirmed the award for this year Dr. J. C. Hunsaker, Council member of A.S.M.E., was elected chairman of the Board of Award to succeed Dr. Lewis. Major Lester D. Gardner, member A.S.M.E., was elected vice-chairman and Elmer A. Sperry, Jr., member A.S.M.E., secretary.

The Daniel Guggenheim Medal Fund was established in 1928 to provide a gold medal and certificate to be presented annually in recognition of notable achievements in the advance of aeronautics, in commemoration of the support given by Daniel Guggenheim to the advancement of aeronautics through donations to universities and for the encouragement of civil aviation. The Fund is administered by nine directors designated by The American Society of Mechanical Engineers, the Society of Automotive Engineers, and the Institute of the Aeronautical Sciences. The recipient of the award is chosen annually by the directors and foreign representatives from England, France, Germany, Holland, Italy, and Japan.

Engineering Courses for Home Study

A REVISION of its home-study course in machine design (mechanism), useful in satisfying college-credit needs, is announced by the extension division of the University of Wisconsin, which teaches many technical subjects by the correspondence-study method. The course is for students who have had at least one year in college and have completed required courses in mathematics and drawing. Consent to transfer credits toward graduation requirements should first be obtained from the school of their choice. Address University Extension Division, Department of Mechanical Engineering, Madison, Wis., for details.

Stevens Institute Offers Course in Work of Frederick W. Taylor

AN EVENING graduate course "The Work and Influence of Frederick W. Taylor: A Survey of Modern Management" is announced for the second semester, beginning February 5, 1940, at 6:30 p.m. in the Navy Building by Dean Frank C. Stockwell of the Graduate School of Stevens Institute of Technology.

Mr. Taylor, a distinguished graduate of the Institute, as a result of his work and studies principally at the Bethlehem Steel Company, presented more than thirty years ago classical papers on the art and science of management before The American Society of Mechanical Engineers, which he served as president in 1906. Taylor and his associates have exerted a profound influence on the policies and procedures of modern management, and he is called the "Father of Scientific Management." The general purpose of the announced course is a critical evaluation of this influence both at home and abroad.

Dr. Dexter S. Kimball, past-president and honorary member A.S.M.E., dean emeritus of the Engineering School of Cornell University, and formerly in charge of courses in industrial engineering at that institution, has been appointed a member of the faculty of Stevens Institute of Technology as lecturer in economics of engineering and will be in charge of the course on Taylor and his work. Dr. Kimball will be assisted in this course by several specialists in the field of industrial management, including Lillian M. Gilbreth, Charles Reitell, D. S. Kimball, Jr., L. P. Alford, Joseph Roe, John Bangs, W. D. Ennis, and Wallace Clark.

All engineers are invited to Dean Kimball's first lecture as guests of the Institute.

Anthracite-Lehigh Has 85 at Bethlehem Meeting

BEFORE an audience of 85, three papers were presented at the Bethlehem meeting of the Anthracite-Lehigh Valley Section held on Nov. 24. Papers and authors were "Steam Compressors," by W. E. Anderson, member A.S.M.E., and engineer with the Pennsylvania Pump & Compressor Co., Easton, Pa.; "New Reciprocating Controllable Capacity Pump," by J. C. Groff, member A.S.M.E., and engineer with Aldrich Pump Co., Allentown, Pa.; and "Variable-Displacement Oil Pumps and Their Application," by H. W. Link, Nathan Pump Co., Philadelphia, Pa.

Public Health Discussed by Baltimore Section

An illustrated lecture on "Engineering Solutions of Medical Problems in Public Health" was given before 250 members and guests of the Baltimore Section on Nov. 8 by Philip Drinker, professor of industrial hygiene, Harvard School of Public Health. According to Dr. Drinker, "The control of our environment, whether we are at work or at play, is an engineering matter." However, but the engineer looks to the physician to tell him within what limits his environment must be maintained. Care of the prematurely born baby is certainly the physician's job, but engineers developed important equipment used in premature nurseries and were in large part responsible for statistical studies designed to determine the optimum atmospheric conditions in such nurseries." A.S.M.E. members J. N. Landis, of New York, and H. H. Snelling, of Washington, D. C., were present.

150 Members and Guests Attend Buffalo Meeting

With 150 members and guests present on Nov. 21, the Buffalo Section presented G. C. Hale, chief of the War Department's chemical-research division at Picatinny, as the guest speaker. He traced the development of explosives from early days until the present day. According to observations made by Mr. Hale on a visit to Germany in 1920 and 1921, he stated that that country's supposed improvements in World War explosives were really "ersatz" devices to replace the explosives, such as picric acid and TNT, which it preferred, but could not get. All members are invited to attend the Jan. 16 meeting when Prof. Walter Rautenstrauch, member A.S.M.E., will talk on "Some Operating Characteristics of the National Industrial Economy."

Industrial Mobilization at Central Illinois

Meeting in Peoria, Ill., on Nov. 16, the Central Illinois Section presented before 150 members and guests a talk by Lt. Col. Donald Armstrong on "The War Department's Industrial Mobilization Plan." According to Colonel Armstrong, "It is not so much large numbers of armed men as large, efficiently organized factories that win a war in the world today . . . our industrial machine must be prepared for war in a world where force seems to prevail."

W. A. Hanley Speaks Before Central Indiana Section

"The Engineer in Management" was the subject of the talk presented before 100 members and visitors of the Central Indiana Section on Nov. 17 by William A. Hanley, member A.S.M.E. He stated that management is essentially a matter of planning and execution, and that a good manager should be a student of people, society, financial trends, sales possibilities, manufacturing problems, and organization.

Today's Automobile at Central Pennsylvania

Central Pennsylvania Section had a turnout of 75 members and guests for the Nov. 29 meeting at which the speaker was O. E. Szekely, who talked on the automobiles of today and their engineering features.

Radiant Heating Described at Charlotte Section

Charlotte Section of the A.S.M.E. and the North Carolina chapter of A.S.H.&V.E. were hosts to members of the Charlotte Engineers' Club at a dinner meeting on Nov. 3. Dr. F. E. Giesecke, Texas A.&M. College, spoke on the subject of "Radiant Heating and Cooling of Buildings." He described the various methods which have been developed for use in modern buildings in the United States and Europe.

Chicago Meetings Attract 575 in Early November

H. M. Black, chairman of the Program Committee of the Chicago Section, reports a series of highly successful meetings during the first part of November. At a joint meeting with the Army Ordnance Association and other organizations on Nov. 6, attended by 350 engineers, Maj. Gen. Charles M. Wesson, Chief of Ordnance, U. S. Army, reviewed the history of the industrial planning for mobilization and told of the extent to which this organization work has now proceeded. He pointed out the increased dependence of a mechanized army upon the industrial resources and organizations of the nation. On Nov. 8, before 130 members and guests, John M. Drabelle, mechanical engineer, Iowa Elec. Light & Power Co., showed colored motion pictures of the furnaces with underfeed, chain-grate, and sprinkler stokers, and pulverized-coal burners, and discussed the stratification of coal gases in power boilers. W. L. Kelly, vice-president, Chicago Molded Products Co., spoke before 60 on Nov. 14, on the subject of "The Development and Application of Plastics." Following the showing of two motion pictures, a discussion on the technical and manufacturing aspects took place. The Nov. 10 meeting was held in the Blackstone Power Plant of the University of Chicago where 35 members and guests were shown the latest equipment by Lyman Flook, superintendent of the plant.

Uses of Coal Explained at Cincinnati Meeting

J. E. Tobey, manager of the fuel-engineering division, Appalachian Coals, Inc., talked before the Cincinnati Section on Nov. 30. His topic was "A Better Understanding of Coal." The paper was well illustrated with slides.

A.S.M.E. COMMITTEE ON LOCAL SECTIONS FOR 1940

(*Standing, left to right:* F. W. Marquis, Ernest Hartford, John P. Ferris. *Sitting, left to right:* H. L. Eggleston, A. J. Kerr, chairman, and J. N. Landis.)

Cleveland Section Holds Two Steam-Power Sessions

Steam power was the subject of both the November and December meetings of the Cleveland Section. On Nov. 9, J. E. Schmeltzer, chief engineer, U. S. Maritime Commission, described to 140 members and guests of the Section the work of the engineering section of the Commission. Since its inception in October, 1937, the organization has built or has on the ways 141 ships. "Generating Power in 1940" was the title of the paper presented on Dec. 14 by James W. Parker, vice-president and chief engineer, The Detroit Edison Co., and vice-president of the Society.

Colorado Members Visit Europe Via Colored Movies

Meeting in Denver on Nov. 25, members of the Colorado Section spent two hours listening to an account of a trip to Europe given by Charles Keller and viewing the colored movies which were used to illustrate the talk.

Story of Inventions Told to Columbus Members

The Nov. 17 session of Columbus Section featured a talk by Dr. W. C. Ebaugh, professor of chemistry at Denison University, on "How Inventions Developed From Dreams to Reality." Among the items considered were antiknock ingredients for gasoline, smelter-smoke treatment, zinc and cadmium production by electrolytic means, porcelain fillings in teeth, and building tiles.

Detroit Section Has Greetings Committee

According to a note sent to old and new members of the Detroit Section, "A warm personal welcome awaits every member who attends the excellent Detroit Section A.S.M.E. meetings if he will only make himself known to a Greeter. The Greetings Committee is again working to make everyone feel at home and definitely a part of local activities. All you need do is to appear at the entrance of the meeting place and speak to one of the men with the big round white badges. Their objective is to introduce you to other members and increase your enjoyment of our splendid technical programs. The aggressive Greetings Committee includes Ernest Abbott, chairman, Ted Winkler, Floyd Price, George Scranton, Buster Lane, Clarence Greene, and many other prominent active A.S.M.E. members."

East Tennessee Section Meets in Chattanooga

An all-day meeting of the East Tennessee Section was held in Chattanooga, Tenn., on Nov. 6. At a joint luncheon meeting with the Chattanooga Engineers Club, 64 engineers heard Roland A. Wank, chief architect of the TVA, speak on "Modern Powerhouses and Related Structures." In the afternoon, 30 members visited the Chickamauga Dam and powerhouse and 12 went through the local plant of the Combustion Engineering Co., Inc. Following an informal dinner in the evening, R. E. B. Sharp spoke to 48 members on "Design and Development of Hydraulic Turbines."

Younger and Mason Talk Before Ithaca Section

The Nov. 17 meeting of the Ithaca Section, which was held in Elmira, N. Y., featured Prof. John E. Younger, head of the mechanical-engineering department at the University of Maryland. He told in a most interesting and informal manner of the scientific way in which the problems of the development of pressure cabins for airplanes are solved at Wright Field. More than 200 members and guests were present at the Dec. 6 meeting to hear Prof. C. W. Mason talk on "Crystal Growth." By the use of chemicals having a low-temperature fusing point, he showed the audience, by projecting through a microscope, the actual process of crystallization of simple materials and others behaving like alloys with eutectic points.

Kansas City Holds Patent Session

Speaker at the Nov. 10 meeting of the Kansas City Section was Henry L. Shenier, patent attorney. In his talk, he traced the development of the American patent system from its background in the English system in the fifteenth century to the present laws and recent revisions.

Los Angeles Hears Peace or War Is Engineer's Problem

Peace or war was called an engineering problem by C. B. Price in a talk presented on Nov. 9 before 250 members and guests of the Los Angeles Section of the A.S.M.E. and other engineering groups.

Mechanized-Cavalry Equipment Described to Louisville

Lt. Col. C. C. Benson, president of the U. S. Army's Mechanized Cavalry Board, described the present and future mechanical equipment of the Army before the Louisville Section on Nov. 21. Lantern slides were used to show the different types of equipment used today, such as motorcycles, repair cars, rolling kitchens, scout cars, tanks, and Diesel engines.

Metropolitan Section to Review Management's Aims

Because so many of the members in the Metropolitan Section attended the 60th Annual Meeting of the Society in Philadelphia, no meetings were scheduled during December in New York City. However, a dozen or more meetings are on the calendar for January, including the general meeting, on the thirty first of the month. This session will discuss the aims and responsibilities of management today. Thomas R. Jones, president, American Type Founders, Inc., as presiding officer, will introduce the speaker of the evening, Harold Coonley, chairman of the National Association of Manufacturers, and chairman of the Walworth Co. The discussion will be led by W. H. Gesell, vice-president, Lehn & Fink Products Corporation, and R. E. Gillmor, president of Sperry Gyroscope Co., Inc.

Keeping up With Lizzie Way out in Minnesota

The Minnesota Section held a dinner meeting on Nov. 27 with 25 members and guests present. Knox Powell, chairman of the Section presided. The address of the evening was given by Dr. C. A. Prosser, director of Dunwoody Institute, who spoke on "Trade and Industrial Education at Dunwoody Institute;" the topic was paraphrased "Keeping up With Lizzie." Teaching methods were explained in some detail with the collaboration of J. F. Sahlin and P. S. Van Wyck, members of the staff of Dunwoody Institute. It was pointed out that the courses being offered are constantly being changed and varied to meet the demands of the times.

New Britain Section Shows Wire Picture

At a meeting on Dec. 7 of the New Britain Section at the State Trade School, a sound motion picture on the manufacture and applications of wire and wire products was shown. According to members who were present, the film was interesting as well as educational.

Joint Meeting of New Orleans Section of A.S.M.E. and L.E.S.

The joint meeting of the A.S.M.E. New Orleans Section and the Louisiana Engineering Society is scheduled to take place in New Orleans, Jan. 12–13, 1940. A tentative program includes the following events:

Friday, Jan. 12, *Morning*, Registration of members and guests; Student Conferences; Members of Student Chapters of Tulane University and Louisiana State University of the Founder Engineering Societies; Reports of outgoing president and officers; Installation of new officers of L.E.S.; and keynote address by Dr. Marten Hoor, dean, College of Arts & Sciences, Tulane University, New Orleans. *Afternoon*, Visitation of industrial plants; and inspection by boat of the harbor facilities of the Port of New Orleans. *Evening*, Address: "Polaroid—The Light Control Material—Its Applications," by George W. Wheelwright, 3rd, of the Polaroid Corporation, Boston.

Saturday, Jan. 13, *Morning*, Address on "Concrete—New Applications in Piling and Architectural Design," by A. J. Boase, manager structural-design department, Portland Cement Association, Chicago; address on "Furnace Design for Burning Liquid, Gaseous,

and Pulverized Fuels," by Otto de Lorenzi, Combustion Engineering Company, Inc., New York; address on "The Wax Lake Outlet and the Charenton Drainage and Navigation Canal," by Lt. Col. William F. Tompkins, district engineer, 2nd U. S. District, Corps of Engineers; and address on "Characteristics and Design of Gas Air-Conditioning Systems," by George Elmer May, engineer, New Orleans Public Service Inc. *Afternoon*, address on "Production of Modern Plastic Products," by Harold A. Levey, consulting chemist and industrial engineer, New Orleans.

North Texas Holds Dinner Meeting for Members and Wives

"Invention is the mother of necessity," stated L. A. Hawkins, executive engineer, General Electric Co., in a talk presented by him before 46 members of North Texas Section and their wives on the evening of Nov. 17. He cited numerous examples.

Ontario Section Welcomes Vice-President Parker

About 75 members and guests of the Ontario Section heard James W. Parker, vice-president of the Society, on Nov. 8, describe the development and operation of the various plants of The Detroit Edison Co., of which he is vice-president and chief engineer. Mr. Parker discussed the different types of power-plant equipment and their development through the years. Both the mechanical and electrical features were gone into and with some fine slides the address was very interesting and instructive. Prior to the meeting Mr. Parker, as Councilor for Group V, met past and present Executive Committee members of the Ontario Section and gave an informal talk on the affairs of the Society.

Science of Crime Detection Subject of Oregon Meeting

I. D. Swenson, head of the Portland F.B.I. office, gave a talk on Dec. 1 to the Oregon Section about the "Scientific Aspects of Crime Detection." A sound movie, "You Can't Get Away With It," was shown and questions answered.

New Glass Developments Told to 338 Philadelphians

"New Developments in the Use of Glass" was the title of the paper presented on Nov. 28 before 338 members and guests of the Philadelphia Section by Dr. C. V. Phillips, Corning Glass Works. Dr. Phillips briefly outlined the early history of glass and traced the development to the present day. He discussed the various constituents used to impart the required properties to glass for use in various fields. There was also a most interesting display of glass products which attracted much attention.

200 Attend Providence Meeting on New 1940 Auto

More than 200 members and guests of Providence Section attended the Nov. 7 meeting which had as speaker, Prof. Dean A. Fales of M.I.T. Professor Fales explained the new hydraulic transmission, sealed reflector lights, direction indicator, and those design trends which reduce driving hazards and improve safety. He also discussed results of road tests made during the snowstorms of last winter and told how to cope with conditions should we have another severe winter.

Raleigh Section Serves Hot Dogs in Forge Shop

"Air Distribution Design" was discussed before the Raleigh Section at its Nov. 28 meeting by Herbert Kunen, specialist in heating and ventilating modern airplanes. Meeting with the section were the student branches of North Carolina State and Duke University, and members of the North Carolina Section of the American Society of Heating and Ventilating Engineers. Kunen's talk dealt with duct designs, sound control, and air measuring instruments. Following the address the audience were guests of the Raleigh Section at a wiener roast in the college forge shop. 200 hot dogs with fixin's were consumed.

Rock River Valley Hears Dr. W. M. White

Dr. W. M. White, Allis-Chalmers Mfg. Co. was the guest speaker at the Dec. 7 meeting of the Rock River Valley Section. The title of the paper was "The Los Angeles Metropolitan Aqueduct." Scanty rainfall and steady increase in population in the Los Angeles drainage basin necessitated the construction of an aqueduct system for an ultimate capacity of 1500 cu ft of water per sec from Parker Dam to the Pacific coast, a distance of 250 miles through deserts and mountain ranges. Unique engineering features were illustrated by lantern slides.

Gustav Egloff Talks Before San Franciscans

San Francisco Section held a joint meeting on Dec. 1 with the S. F. Engineering Council and other engineering groups. Before 250 people, Dr. Gustav Egloff, famous research engineer, discussed modern motor fuels. He gave a very interesting and instructive résumé of the newer methods of production of motor fuels with special reference to catalyst methods of refining and production of high octane numbers of fuel with reduced economy and convenience.

St. Louis Section Members Themselves Discuss Power

Following a dinner on Dec. 1, members of the St. Louis Section had a very interesting discussion on power. Subject covered cost, purchased versus generated power, smoke measures, various fuels, equipment, and operating problems.

Susquehanna Engineers Look at Profit System

The meeting of Nov. 6, held jointly with the York Engineering Society, had an attendance of 52 at the dinner and 110 at the technical session which followed. The speaker was Dr. Harvey N. Davis, past-president of A.S.M.E. and the title of his talk was "An Engineer Looks at the Profit System." The paper dealt entirely with the flow of money in a capitalistic economic system, such as the United States. An important point brought out was that total profits must equal total debts.

Superfinish Discussed at Toledo Section

"Superfinish," the latest Chrysler development, was described before the Toledo Section on Nov. 16 by A. M. Swigert, production-research engineer, Chrysler Corporation. There was a complete display of parts together with a slide-film series showing superfinishing machines in operation.

Virginia Section Has All-Day Affair

The all-day meeting on Nov. 4 of the Virginia Section held with the V.P.I. Student Branch of the A.S.M.E. attracted more than 100 participants. The program consisted of a technical session in the morning at which talks were presented by W. E. Mason, student member A.S.M.E., on production of all-metal aircraft, H. C. Archer, student member A.S.M.E., on airships, J. W. S. Wise, on some important aspects of naval architecture, and E. C. Wiley, member A.S.M.E., a radio talk over WDBJ by G. C. Mollerson, vice-chairman of the Section, on "The Engineer of Tomorrow;" a luncheon at which George L. Bascome, chairman of the Section, presided; and a football game in the afternoon between V.P.I. and Furman University.

125 Attend Washington, D. C., Section Meeting

More than 125 members and guests of Washington, D. C., Section attended the Nov. 9 meeting at which Dr. F. L. Miller and Albert H. Dall were the speakers. Dr. Miller discussed corrosion of bearings caused by lubricants and the relation of bearing-metal structure to corrosion. Mr. Dall described the application of segmental bearings to grinder spindles making possible greater grinding accuracy.

82 at November Meeting of Western Washington Section

The scene of the Nov. 15 meeting of Western Washington Section was the University of

Washington in Seattle and the audience consisted of 82 engineers, including 50 who had partaken of dinner prior to the session. Prof. George S. Wilson described the main features of the new boiler and auxiliaries installed in the University's powerhouse, gave performance and test data, and illustrated his talk with slides. Following a discussion and question period, all were taken to the powerhouse to see the unit in actual operation.

Detroit Engineers Get New $1,500,000 Building

FINAL arrangements for the construction of a $1,500,000 building in the art-center group in Detroit to serve as permanent headquarters for the Engineering Society of Detroit and the University of Michigan Extension Service were recently announced. A memorial to the public spirit and philanthropy of the late Horace H. Rackham and of Mary A. Rackham, the building will combine professional, scientific, and educational activities and "will be a tribute to the high level of technical accomplishment long associated with Detroit," according to Society officials. The building will be known as the Horace H. Rackham Educational Memorial.

The Memorial will be located on the south side of Farnsworth Avenue, facing the Detroit Institute of Arts and diagonally across from the Detroit Public Library. Construction is scheduled to begin early in 1940. The exterior of white limestone, with marble spandrels and simple ornamental carvings, will house three distinct units of the building. The central section will be a large auditorium, seating 1000 persons, which will be at the disposal of both the Engineering Society and the University. The auditorium will be flanked on the east by a wing housing the Engineering Society and on the west by a wing devoted to the University's Extension Service. The entire Memorial will be 404 feet in length and will vary in depth from 150 feet at the center to 65 feet at the ends.

The three-floor Detroit Engineering Society wing, with approximately 45,000 square feet of floor space, has been carefully planned to provide facilities for the scientific, professional, and social activities of the engineering organization, which is the largest local engineering society in the world, and its affiliated societies. An extensive library will be housed in a second-floor room over the entrance of the Memorial Auditorium.

Invitation Extended to All by Houston Engineers Club

The Houston Engineers Club extends an invitation to nonresident members of the A.S.M.E. to make use of the Club's quarters and facilities at 2615 Fannin Street, Houston, Texas, and to participate in the luncheon meetings held on alternate Tuesdays at the Rice Hotel. The Club is also making its quarters available for meetings of local engineering and scientific groups; and local sections of the national Founder Societies will be invited to make the Club their local headquarters.

Junior Group Activities

Junior Electrical Engineer Wins Alfred Noble $500 Prize

THE Alfred Noble Prize of $500 for 1939 has been awarded to Claude E. Shannon, Junior member of the A.I.E.E., for his paper entitled "A Symbolic Analysis of Relay and Switching Circuits." Besides the cash prize, Mr. Shannon will also receive a certificate signed by the president and secretary of the American Society of Civil Engineers and bearing the names of this and the other engineering Societies participating in the award, namely, the American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Western Society of Engineers. The presentation will be made during the annual meeting of the A.I.E.E. in New York, Jan. 22–26, 1940.

Every Junior of the A.S.M.E. is eligible to take part in the contest for the 1940 prize of $500. Further details may be obtained from Society headquarters.

Cleveland Juniors Hear Photoelasticity Talk

THE Junior Group in Cleveland was invited in a body to attend the Nov. 20 meeting arranged by the machine-design division of the Cleveland Engineering Society. The speaker was Dr. Max M. Frocht, associate professor of mechanics at Carnegie Institute of Technology. His subject was "Photoelasticity as Applied to Machine Design." Dr. Frocht, who has spent many years of intensive research on this subject, first outlined the fundamental laws of mechanics of materials on which the interpretation of the theory of photoelasticity is based. Then he demonstrated, by means of transparent models of bakelite, the manner in which interference fringes are formed in different sections by various conditions of loading. He concluded his talk by showing how misleading can be the conventional simplified design of a member in tension on the basis of transverse cross-sectional area.

Los Angeles Juniors Visit Rubber-Manufacturing Plant

ON NOV. 6, a group of 30 Juniors visited the Kirkhill Rubber Co., where following a talk by Mr. Pierce illustrated by colored motion pictures, the manufacturing operations in the plant were observed.

New England Engineers Form Committee to Help Juniors

A COMMITTEE on Engineering Education and Professional Development has been formed by the Engineering Societies of New England in an endeavor to develop a worthwhile program for the younger men in the engineering profession. Prof. Joseph W. Zeller, Northeastern University, 360 Huntington Avenue, Boston, Mass., as chairman of the Committee, asks that A.S.M.E. Junior Groups cooperate in the work by sending to him any suggestions and comments which will prove helpful.

New Orleans Junior Group Sponsors Study Courses

SPONSORED by the New Orleans Junior Group, a series of study groups are being conducted to give members an opportunity to develop their technical knowledge. For December, the free course consisted of a series of lectures on industrial electrical installations given on Dec. 5, 12, and 19, by M. G. Zervigon, instructor in electrical engineering, Tulane University, and M. C. Abraham, assistant engineer, New Orleans Public Service.

Philadelphia Juniors Very Active During November

ON Wednesday, November 8, the Juniors of the Philadelphia Section met with Mr. Everett Chapman, president of Lukenweld, Inc., as their guest speaker. In a pleasantly edifying talk, Mr. Chapman explained some of the more common faults of welding and cited methods whereby these faults might be overcome or avoided. His lantern slides and movies of bakelite models were striking examples of the possible effects of errors in profile and heat-treatment in welding.

On the following Wednesday night, Nov. 15, a trip was made to the turbine plant of the Westinghouse Electric and Manufacturing Co. There members had a chance to observe at first hand some of the niceties of turbine construction. This included many details of machining, fabrication, construction, and testing. Much interest was shown in the manufacture of the blades, in the precise machining of heavy gears and casings, and in the testing of the completed turbines.

San Francisco Junior Group Holds Interesting Meetings

SAN FRANCISCO JUNIORS opened their 1939–1940 calendar with two interesting seminar sessions. The Oct. 19 machine-design session included a discussion of "Gear Design," by E. S. Polemik, Pacific Gear and Tool Works, and a presentation by Marian B. Hughes, American Can Company, on the more general subject, "Machine Design." Mr. Polemik gave a brief historical sketch of the evolution of the gear as a machine, and then developed the simpler mathematical relations which hold for spur, helical, and worm gears. He also discussed the design of gears for particular ap-

plications based on desired speed, gear ratio, load, quietness, and efficiency. Mr. Hughes discussed a number of the factors which must be considered by the machine designer. He mentioned the function of the machine as the obviously most important of these. Others were appearance, materials, accessibility, lubrication, and standard practice.

On Nov. 16, at a "National Defense" meeting held at the San Francisco National Guard Armory, Sidney W. Newell, an engineer for the Union Diesel Engine Company, discussed "Our Fishing Fleet and National Defense." The Pacific fishing fleet is composed of sturdy Diesel-powered "Purse Seiners" and "Tuna Clippers" manned by hardy experienced crews who have an intimate knowledge of the coast line. The boats can at small expense be equipped for naval auxiliary service in case this country should require an intensive coast defense against a foreign power. Their chief duty would be to patrol and keep the coastal waters under close observation. They can also be used for combating submarines with depth charges, for mine sweeping, and possibly for mine laying.

At the conclusion of the lively discussion aroused by Mr. Newell's presentation, Sam Dows, captain of the California National Guard and a member of the A.S.M.E., conducted the group through the Armory. He explained the purpose and operation of the various pieces of equipment used by coast-artillery troops and gave members an opportunity to watch the men at drill on 155-mm guns and in the plotting rooms.

With the Student Branches

Branch Meetings

Alabama Visits Paper Mill

MEMBERS and guests of ALABAMA BRANCH visited the local plant of the Gulf States Paper Corp. on Nov. 16. A picture of the group making the trip was sent in by Leonard Mandell, Branch secretary, for reproduction in MECHANICAL ENGINEERING, but the grayness of the print did not permit its use for a halftone.

ARMOUR BRANCH is very active nowadays. On Nov. 10, more than a hundred members and guests listened to a talk by John S. Townsend, superintendent of maintenance at the South Works of the Carnegie-Illinois Steel Mills, on the subject of safety. Then, on Nov. 13, the members made an all-day inspection trip to Milwaukee where they visited the Allis-Chalmers and A. O. Smith Corporation plants. On Dec. 2, the Research Foundation of the Institute announced the completion of the foundation for an experimental foundry, which will be equipped with furnaces, pressure pots, core ovens, and all other foundry facilities.

AUBURN BRANCH had as visitors at its Nov. 13 meeting the members of the A.I.E.E. chapter. The program consisted of the showing of two motion-picture films, "The Story of a Storage Battery," and "The Story of Asbestos."

British Columbia's Big Meeting

BRITISH COLUMBIA BRANCH had several meetings during November, but the best one in the matter of attendance was that held on Nov. 8. Approximately 30 members and 45 visitors saw motion pictures on the construction of the Grand Coulee Dam. On Nov. 15, sound motion pictures showing the manufacture of alloy steel were provided through the courtesy of the Bethlehem Steel Co. Finally, on Nov. 22, student member Charlie Parker gave a paper on "Air Conditioning of Railway Cars."

BUCKNELL BRANCH members learned all about safe driving from a motion picture shown at the Oct. 17 meeting.

CALIFORNIA BRANCH met on Nov. 9 and heard Al Champion and George Brokaw describe a device developed by them to measure transient temperatures more rapidly than any method now existing. They were followed by R. C. Powell, mechanical engineer for P.G.&E., who spoke on the three new steam-generating plants now being installed in the Bay area.

Supercharged Planes at Cal. Tech

Bruce Del Mar, research and development department of Douglas Aircraft Corporation, gave a talk on Nov. 3 to members of CALIFORNIA TECH BRANCH on "The Tendency Toward Supercharging Airplane Cabins." He demonstrated several breathing devices used at high altitudes and showed slides on the latest developments in pressurizing cabin airplanes.

CARNEGIE BRANCH held its first evening meeting of the year on Nov. 16. After viewing a motion picture on the various commercial processes for fabricating aluminum, the members discussed plans for future inspection trips. Refreshments and piano playing by the more gifted members followed.

Case Plays "Battleship"

CASE BRANCH held its annual dinner and entertainment on Nov. 16, which terminated this season's highly successful membership drive. Following the "eats," the 54 members and four faculty members went to the mechanical-engineering building where the boys engaged in a new game, called "Battleship." Winners were awarded popcorn balls while the losers received suckers (lollypops).

CATHOLIC UNIVERSITY BRANCH members got together on Nov. 8 to hear Robert O'Leary, '25, assistant patent examiner in the U. S. Patent Office, give an illustrated lecture on refrigerants and refrigerating machines.

CINCINNATI BRANCH had 110 at an organization meeting on Nov. 20. Chairman Harold Gregory appointed Don Campbell as chairman of the Committee on Intramural Athletics, and Clyde Eby as chairman of the Committee on Social Functions. Big doings are promised by the new chairmen.

C.C.N.Y. BRANCH invited R. Judson, Brooklyn Edison Company, to give a paper on "The Importance of Safety to the Engineer" at the Dec. 6 meeting. As part of the holiday season, the members held a laboratory dance on Dec. 16.

Colorado Meetings

COLORADO MINES BRANCH heard a talk by J. Erwin, superintendent of Denver shops of the Burlington & Quincy R.R., on the operation and maintenance of the new Diesel-powered streamlined trains. This climaxed a recent inspection trip by members of the Branch to the shops.

COLORADO STATE BRANCH had its largest attendance so far this year at the meeting of Nov. 13. Exactly 49 members crowded into the meeting room to view six reels of motion pictures showing the manufacture of steel pipe, from the smelting of the ore to the welding of the pipe. Coffee and sweet rolls were served.

COLORADO BRANCH held a joint meeting on Nov. 8 with the A.I.E.E. student chapter. Movies describing oil-well drilling and operation were shown. The attendance was 121.

ARMOUR INSTITUTE STUDENT MEMBERS VISIT A. O. SMITH CORPORATION IN MILWAUKEE, NOVEMBER 13, 1939

THE DETROIT A.S.M.E. STUDENT BRANCH TEAM WHICH OPPOSED THE A.I.E.E. IN A "BATTLE OF WITS"
(The electricals won by a score of 1690 to 1295.)

REV. J. B. DWYER ACTED "PROFESSOR QUIZ"
(Presenting the prize, an electric-tuning slide rule to J. C. Price, A.I.E.E. Chairman, while A. J. Hofweber, A.S.M.E. Chairman, looks on.)

COOPER UNION BRANCH (evening) at its regular meeting on Nov. 13 heard a paper by one of the student members, Howard Anderson, who described the "Manufacture of Soap Flakes." On Saturday morning, Nov. 25, several members went through the Pitz Foundry, which is located in Brooklyn, N. Y.

Employment at Cornell

CORNELL UNIVERSITY officials reported in November that 95 per cent, or all but six members of the class of 130 who were graduated in June, 1939, from the College of Engineering have found employment. Chemical engineers are placed 100 per cent, civil engineers 96 per cent, electrical engineers 95 per cent, mechanical engineers 98 per cent, and administrative engineers 91 per cent.

DETROIT BRANCH, in conjunction with the A.I.E.E. student chapter, had a meeting on Nov. 7 devoted to a "battle of wits" between the two groups. The trophy was an "electric-tuning slide rule" with chromium and plastic fittings, lights, and a bell. Using a variable transformer and a reversing motor, the rule works at the touch of a button. However, its accuracy is low, reports Vincent D. Pohlmeyer, Branch secretary, and therefore it doesn't matter that the E.E.'s won it with a score of 1690 to 1295.

Duke College of Engineering

In accordance with a resolution adopted by the Board of Trustees of DUKE UNIVERSITY in November, the division of engineering, which was administered as part of Trinity College, was reorganized into the College of Engineering of the University. W. H. Hall, professor of civil engineering, has been appointed dean of engineering. Three curricula in engineering, civil, electrical, and mechanical are offered. The enrollment, which has been set at a maximum of 225, is now 216.

GEORGE WASHINGTON BRANCH offered a very interesting program to the 79 members and guests who were present at the meeting of Nov. 1. Lieut-Commdr. A. M. Morgan, construction corps, U. S. Navy, gave a talk on the "Rescue and Salvage Work on the *Squalus*," based on his active duty at the scene of the disaster.

GEORGIA TECH BRANCH members and guests, numbering 80, got together on Nov. 6 to hear a talk on research given by C. A. Stewart, General Motors Research Division. He illustrated his talk with many examples of what is being done today to improve present methods and to find ways of doing impossible things.

Iowa Hears Student Talks

More than 60 student members of IOWA BRANCH turned out on Nov. 29 to listen to a series of talks given by fellow members. Harry Zeisloft described various types of airplane propellers together with their advantages and disadvantages. Lloyd Keil took the boys on a verbal visit to Boulder Dam. The last speaker for the day, Ted Schroeder, discussed the use of motion pictures in industry.

ILLINOIS BRANCH had more than 100 present at each of the November meetings. On Nov. 2, Professor Kongo showed a colored movie on "Combustion in an Underfeed Stoker." For the meeting on Nov. 16, the guest speaker was Harold Nutt, who gave a paper on "The Single-Plate Automotive Clutch." On Nov. 30, the boys heard a paper on "The Engineering Principles of the Electrolux Refrigeration Unit," which was given by Dr. R. M. Buffington.

IOWA STATE COLLEGE BRANCH listened to a round-table discussion on Nov. 15 by Robert Grange, Jerry Braun, and Don Reading, who told of the recent trip of the senior students to Chicago and Milwaukee where many different types of industrial plants were visited.

KENTUCKY BRANCH again transacted a lot of business at the Nov. 3 meeting, leaving no time for technical papers. Many branches are avoiding this difficulty by having the executive committee or a special committee take care of the business.

Lewis Visits Studebaker

On Nov. 15, an inspection trip through the Studebaker Motor Co. plant at South Bend, Ind., was made by 48 student members of LEWIS BRANCH. The company provided free lunch, after which the boys were shown the engineering, testing, and final assembly departments.

LOUISVILLE BRANCH had student papers presented at both the Nov. 7 and 23 meetings. Among those who talked were Edelhauser, McKercher, Hoeing, and Droppleman.

Marquette Sells Flowers

Following a tradition of 19 years, the MARQUETTE BRANCH again undertook the manufacture and sale of flowers in order to accumulate a fund for a Branch scholarship. This year, Hank Obremski invented a device to speed up the production of the flowers which were sold with the cooperation of the co-eds.

MICHIGAN BRANCH is growing with the University. According to a report issued in November, engineering registration stood at 2151 as compared with 2059 last year. The majority of the 75 student members in the Branch are attending the meetings which, during November, featured talks by John Airy, King-Seely Corporation of Ann Arbor, on "Education and the Young Engineer," and by Dr. Ernest J. Abbott, Physicist Research Co., on "Surface Finish," an inspection trip through the Ford River Rouge plant, and a motion picture on lubrication.

MINNESOTA BRANCH held its annual "Bean Bust" on Nov. 15 in the Minnesota Union with large-sized beans and other food, door prizes, souvenirs, entertainment, and group singing. On Dec. 1, the boys paid a visit to Pig's Eye Island to look over the new Twin Cities Sewage Disposal plant there.

MISSOURI MINES BRANCH presented on Dec. 1 a motion picture on the history, processing, and use of processed coal. The film was made available through the courtesy of the Peabody Coal Co.

A.S.M.E. STUDENT BRANCH MEMBERS AT UNIVERSITY OF COLORADO

STUDENT MEMBERS WHO ATTENDED A JOINT MEETING OF THE STUDENT BRANCHES OF THE UNIVERSITY OF KENTUCKY AND THE UNIVERSITY OF LOUISVILLE, OCTOBER 13, 1939

NEWARK BRANCH held its monthly meeting on Nov. 1. Professor Walter of the faculty and Mr. James of the Hudson Coal Co. were the main speakers.

New Hampshire Speakers

So far this year, papers have been presented by the following student members of NEW HAMPSHIRE BRANCH: Richardson, Hardy, Whitcher, Cheesman, Gardner, Young, Elliot, Hall, Taylor, Gay, Dennett, Lord, Styrna, and Brosius. For the March issue of this magazine, Secretary Whitcher has promised to send a photo of the Branch's first and only woman member.

NEW MEXICO BRANCH members were given a paper on Nov. 28 by John Linderberger on "Preliminaries in Obtaining a Job." Questions and discussion followed.

N.Y.U. BRANCH (evening) reports 33 paid-up members this year. Part of the credit for this accomplishment belongs to the Program Committee which has been doing an excellent job.

NORTH DAKOTA STATE BRANCH is already making plans to win the main prize at the Student Group Conference this spring. Jimmy Christen started the ball rolling at the Nov. 15 meeting by giving a paper on the new 1940 automobiles.

NORTHEASTERN BRANCH reports the election of new officers on Nov. 21. They are Robert Drinkwater, chairman; Richard McManus, vice-chairman; Carl Lanzilli, secretary; and Harry Ferguson, treasurer.

Northwestern Welcomes Eshbach

NORTHWESTERN BRANCH welcomed the new dean, Ovid W. Eshbach, at its first meeting on Oct. 16. Dean Eshbach, in a brief talk, showed the relationship of the student to the faculty and to extra-curricular activities.

NOTRE DAME BRANCH had an attendance of 132 members and guests at its open meeting on Nov. 14. "Modern Trends in Turbine Design" was the subject of the film shown.

OKLAHOMA BRANCH invited Bernard Jones to give a report on positive displacement meters at the Nov. 16 meeting. The test is being carried out at the University by Mr. Jones and the results turned over to the U. S. Bureau of Standards and several meter companies.

OKLAHOMA A.&M. BRANCH members met on Nov. 13 with other engineering groups and heard illustrated talks by Professors C. E. Bardsley and R. E. Kirkham on astronomy and summer camp activities.

PENNSYLVANIA BRANCH devoted its meeting on Nov. 15 to a study of the activities of Germany and Russia. Professor Shulty led the discussion. Following this, three reels of motion pictures on antiaircraft defense were shown.

PRATT BRANCH members saw a sound-motion picture on the design, manufacture, and application of various types of refrigerating equipment at the meeting of Nov. 1.

Diesel Movies at R.P.I.

RENSSELAER POLY BRANCH met on Nov. 15 to see three talking pictures. The first film, "Diesel Engines," discussed the compression pressure, the second, "Uses of the Diesel Engine," showed applications in trucks, tractors, and bulldozers, and the third, "The Right Materials in the Right Places," illustrated the art of extracting metals from their ores and adapting them to various purposes.

SOUTHERN CALIFORNIA BRANCH held two meetings during November. The first, on Nov. 8, featured a paper on "The Velocity Measurement of Projectiles," by J. Nass. "Heat" was the title of the motion picture presented at the Nov. 22 meeting before 41 members and guests.

SOUTHERN METHODIST BRANCH members and other students were the guests of Prof. Ray M. Matson at his home on Sunday, Oct. 8. The function was held to give all mechanical-engineering students an opportunity to get acquainted.

SWARTHMORE BRANCH devoted its meeting of Nov. 21 to a discussion of the membership drive, the coming joint smoker with VILLANOVA BRANCH, and the 60th Annual Meeting of the Society.

In a recent letter to Society headquarters, Prof. Roscoe W. Morton, honorary chairman of TENNESSEE BRANCH reports, "We are having a lot of fun in the Branch this year since the boys are giving their own programs, which have been exceedingly interesting so far. . . . We are covering subjects that we do not find time or place to fit into the regular courses."

TEXAS BRANCH got off to a fine start on Oct. 30 by having two student members present papers which evoked considerable discussion. Papers presented and their authors were: "Advances in Refrigerated Freight-Car Design," by William Lubbock, and "The Design of a Portable, Compact, Immersion Quick Freezer," by W. R. Woolrich, Jr. On Nov. 13, the Branch members made an inspection trip to the Texas Quarries, Inc.

TEXAS A.&M. BRANCH had a turnout of 90 members at the Nov. 21 meeting. Before the introduction of the speaker, cigars were passed out. Major R. E. Hill gave a talk about the latest types of antiaircraft defense equipment which, in light of the wars going on now in other parts of the world, proved very interesting.

TORONTO BRANCH members met on Nov. 6 to hear a talk by R. L. Rude, British-American Oil Co., on "The Development of the Oil-Refining Process," in which he discussed early methods and the improvements made during 1914–1939.

Vermont Very Active

On Nov. 17, VERMONT BRANCH members visited the Edlund Mfg. Co. plant in Burling-

NORTHWESTERN UNIVERSITY STUDENT BRANCH OF THE A.S.M.E.—DIVISION B

ton, Vt., and watched the fabrication of egg beaters, bottle openers, can openers, capping machines, etc. Recent meetings of the Branch have featured talks by Louis Zambon and Elliot Hawkins.

VIRGINIA BRANCH discussed a lot of business at its Nov. 7 meeting. Of special interest to other Branches was the appointment by Chairman T. Gibson Hobbs of a special committee to prod members to write and send in papers for the Society's Charles T. Main prize of $150.

Members of this special prodding committee are H. R. Hughes, J. D. Hamm, and L. S. Stevens.

Washington Wins

It was announced at the Nov. 16 meeting that the WASHINGTON BRANCH had won the pennant awarded annually to the engineering group having the greatest number of members present at the annual Engineers' Banquet. In the intra-engineering touch-football league, the M.E.'s topped the list by winning every game this season.

WISCONSIN BRANCH members numbering more than 60 visited the Madison Gas and Electric Company's latest power plant on Nov. 28. Some of the members claimed that this was the best event yet held by the Branch this season.

United Engineering Trustees, Inc., Reviews Activities for 1938-1939 in Annual Report

President D. R. Yarnall Summarizes Facts Concerning Building, Funds, Library, and Engineering Foundation

THE ANNUAL REPORT of the United Engineering Trustees, Inc., for 1938-1939, was issued on Oct. 26, 1939, by President D. Robert Yarnall, fellow A.S.M.E. In his letter of transmittal to the Board of Trustees and the Founder Societies, Mr. Yarnall starts by reviewing the corporate functions of the organization. The charter granted by the State of New York defines the objects of the Corporation as "the advancement of the engineering arts and sciences in all their branches, and to maintain a free public engineering library." It further grants, in addition to "the general powers and privileges of a corporation," power "to take real and personal property by grant, devise, or bequest, and to use, and maintain, occupy, lease, mortgage, and convey the same." It orders further that, "any building erected by the corporation hereby created shall be used perpetually, in whole or in part, as a meeting place and headquarters" for the Founder Societies. Thus are definitely specified as duties, the care of Engineering Societies Building, the operation of Engineering Societies Library and the financial operations essential to the care of funds left to the Corporation "for the advancement of the engineering arts and sciences or for the good of mankind," with regard both as to safety of principal and as to maintenance of maximum income.

Engineering Societies Building

Engineering Societies Building was the meeting place of the ninth stated meeting of the Board of Trustees of United Engineering Trustees, Inc. (then United Engineering Society) held on November 22, 1906. This was the first meeting of the Trustees in the completed building. The cornerstone had beenl aid by Mrs. Andrew Carnegie on May 8, 1906, and the dedication was held on April 16–19, 1907. Thus the building has had thirty-three years of active life as headquarters of the great national engineering societies. During this span of years changes have been made as needed and a high standard of physical condition of the property has been maintained. During the last summer, under the direction of the Real Estate Committee, new heating-system controls were installed to insure a constant heat supply in all parts of the building, and in addition to this added comfort to the occupants, a decreased consumption of steam will reduce operating costs. Some improvements have been made in ventilating the meeting halls at a very low expenditure of money. Other expenditures have included new cables for the elevators, painting the cab interiors, and renewing the worn floor covering and painting in various parts of the building. Few buildings in these times remain useful over a period as long as has the Engineering Societies Building and increasing renewals must be anticipated. Periodic fire-prevention and insurance-rating inspections assist the housekeeping with helpful recommendations.

Finances

The year has been marked by refunding at greatly reduced rates of interest. Toward the close of the year the outbreak of war confused market conditions and further disturbed investments. Because of the low money rates prevailing a number of relatively high-yield high-grade bonds were called during the year. In order to maintain income at the best level obtainable consistent with adequate security of principal, the Finance Committee was obliged to purchase securities with a lower rate of return. During the fiscal year just ended the return on the book value of the securities was 4.01 per cent compared with 4.4 per cent for the previous year. Bequests have been received during the year from the estates of: Sophie M. Gondran, $25,000; Karl Emil Hilgard, $1776.63; and Richard Khuen, Jr., $2000.

The John Fritz Medal Fund Corporation, incorporated 1903, and The Daniel Guggenheim Medal Fund Inc., incorporated 1927, each dissolved its corporation in 1939 and became committees of United Engineering Trustees, Inc. This action did not change any status except in name because the John Fritz Medal Board funds had been held by United Engineering Trustees, Inc., for many years, and while the Daniel Guggenheim Medal Fund Incorporated had maintained its own bank account, its books had been officially kept by United Engineering Trustees, Inc., for a long period. Therefore the formal acceptance of responsibility for these dissolved corporations was considered by the Board as only legalizing the regular procedure. U.E.T. is treasurer of Engineers' Council for Professional Development. It is also custodian of the Engineering Societies Employment Service Relief Fund.

Engineering Societies Library

The year, which ended on Sept. 30, 1939, was marked by increased use and enlargement of facilities of the Engineering Societies Library. It was used by 43,110 persons, 1160 more than in the preceding year. Of these, 32,741 visited it in person and the remaining 10,639 were assisted by mail and telephone. During the year, the collection was increased from 144,262 volumes, 7408 maps, and 4391 searches to 146,999 volumes, 7564 maps, and 4440 searches. In addition 3399 pamphlets were added to volumes already counted. There are also approximately 13,000 duplicate volumes on hand. The number of periodicals received currently was 134.

The periodical index now contains over 242,000 references to important periodical articles, classified by the system that is used for the book collection. It is gratifying to report

SUMMARIZED FINANCIAL REPORT, SEPT. 30, 1939

Land, building, and equipment		$1,993,793.92
Funds:		
Engineering Foundation	$895,849.50	
Edward Dean Adams	90,911.06	
Library endowment	168,346.55	
Depreciation and renewal	415,225.16	
General reserve	10,193.86	
		1,580,526.13
The Daniel Guggenheim Medal Fund		15,840.00
John Fritz Medal Fund		3,500.00
Henry R. Towne Engineering Fund		48,633.53
Cash		24,671.88
Accounts receivable		1,315.39
The Engineering Foundation (unexpended)		23,884.80
Alloys of Iron Research (unexpended)		7,088.30
Welding Research (unexpended)		726.05
The Engineering Foundation Custodian Fund		6,623.44
Other custodian funds		1,547.40
Total assets		$3,708,150.84

that the number of readers who consult this index is growing steadily. During this year the additions to the citations upon mining and metallurgy have been especially noteworthy.

During the year 14,358 gifts were received. It is not feasible to mention all of the donors here, but attention is directed to a few of unusual size or interest. Mrs. Henry Alexander presented complete sets of a number of important periodicals, and many books. G. M. Basford donated many proceedings of railway associations, and F. G. Clapp a valuable collection of manuscript translations of foreign papers upon the geology of the Asiatic oil regions. Through the courtesy of H. A. Hopf, gaps in the files on International Management Congresses were filled. Murray and Flood presented a useful collection of electrical books and periodicals, and the New York Society Library a large number of early technical books. The *Engineering News-Record* sent many contributions of books and pamphlets.

The Engineering Foundation

The Engineering Foundation, a department of United Engineering Trustees, Inc., sponsors and assists in a wide range of research projects, many of which are producing results of immediate practical value to science, engineering, industry, and the public. Most of the projects deal with engineering researches of a technical character, but some, such as Engineers' Council for Professional Development, deal with nontechnical matters of concern to the engineering profession, educators, and the public. The results from the various researches are published by the appropriate professional societies, educational institutions which maintain research laboratories, and the technical press. Work on 16 active projects has progressed during the year. These projects included 33 specific problems, including the following in which the A.S.M.E. is interested.

Effect of Temperature on the Properties of Metals: Project 45 ($1000). N. L. Mochel, chairman. A preprint of a Report of Joint Research Committee was submitted at the June 26–30, 1939, meeting of the American Society for Testing Materials. It gave brief information concerning 11 research projects and appendixes contained three technical papers. The work is being continued.

Critical-Pressure Steam Boilers: Project 50 ($1000). Dean A. A. Potter, chairman. The studies on the viscosity of steam have been completed and a paper was presented at the 1939 Annual Meeting of the A.S.M.E. held in Philadelphia. The work on the corrosion of steels at high temperature is in progress and a paper probably will be submitted during the next fiscal year.

Fluid Meters: Project 30-b ($1000). R. J. S. Pigott, chairman. For several years the Committee has had in progress a research investigation to determine the coefficients for flow nozzles. This has required much test work and the raising of a large fund to carry it on, with both of which the Committee has been most successful. There remains a small amount of test work to be done but the major task now is to correlate the data and arrange it for presentation in a suitable manner. Many articles on this research have appeared in the technical press so that Industry has been kept informed of its progress.

Lubrication: Project 23 ($1000). Professor G. B. Karelitz, chairman. The Committee's work is progressing along four distinct lines: (*a*) The continuation and further development of the work on the mechanics of thick oil, (*b*) the field of boundary lubrication mainly by the correlation and publication of data obtained in laboratories, (*c*) the general problem of thermodynamics of bearings, and (*d*) the pressure-velocity relationships. Work on the bibliography of lubrication is progressing.

Cottonseed Processing: Project 52 ($500). Dean W. R. Woolrich, chairman. Robert Brooks Taylor in charge. Studies in cooker designs for continuous and automatic operation were initiated, as were studies for the purpose of improving the design of the batch type of cooker to permit economies in the manufacturing cost of the unit. Suitable automatic controls were also investigated for possible application with the batch type of cooker. To satisfy the demands of the industry, a commercial humidifier was designed, built, and placed in commercial operation for demonstration purposes.

Specially designed hydraulic press plates were built to the specifications and installed during the concluding two weeks of experimental crushing operations on cottonseed only. Work in this phase of the research is in an advanced preliminary investigation stage. Preliminary data indicate that the new press-plate design permits a more rapid flow of oil which should permit shorter pressing cycles, thereby imparting greater pressing capacity. No perceptible improvement in total oil yield was obtained. Before expanding the research program to attempt designs or inventions of suitable machinery for the economical recovery of furfural, lignin, and other constituents of the cottonseed hull, as well as suitable machinery for the economical recovery of cottonseed protein, it is proposed to concentrate on completing those problems which the Committee was unable to prosecute to a conclusion during the year as the program for the ensuing year.

Rolling Steel: Project 68 ($800). Dr. A. Nádai, chairman. A Committee with a membership of eight, including Dr. Nádai, is in charge of this work. Work was begun May 2, 1938. A special tension apparatus has been designed and built, in which bars one inch gage length and $^3/_{16}$ inch diameter can be pulled in tension at temperatures up to 1200 C, and at high stretching velocities. Bars are heated in an induction furnace, which can be connected to an existing oscillator equipment in the Westinghouse Research Laboratories, which afforded their facilities for making the tests. It is hoped that with this apparatus the yield stresses required to deform steel at temperatures from 20 C to 12 C at a side range of velocities may be determined.

Mechanical Springs: Project 59 ($500). J. R. Townsend, chairman. This grant has been used to assist in the financing of the publication of a treatise entitled "Strength of Metals With Special Reference to Spring Materials and Stress Concentration," by D. J. McAdam and R. W. Clyne.

Riveted Joints: Project 60 ($500 + $399.13). N. E. Funk, chairman. These grants were made in order to provide for the publication of a bibliography constituting "A Critical Review of the Literature Concerning Riveted Joints." Unsuccessful attempts were made to collect enough funds to provide for 1000 copies of a printed book. It is now proposed to print about 300 copies at the smallest practicable cost for limited distribution.

A.S.A. Holds Annual Meeting in New York City on Dec. 13, 1939

THE Annual Meeting of the American Standards Association was held Dec. 13 at the Hotel Astor, New York City. It consisted of a luncheon meeting, preceded by a meeting of the Standards Council in the morning and followed by the joint annual meeting of the board of directors and the Standards Council in the afternoon. Some 250 executives and engineers at the luncheon listened to Richard Lansburgh, director of the Pennsylvania Economy League, speak on "Standards as an Integrating Community Force."

A.S.A. Activities

Reporting on the year's activities, Edmund A. Prentis, president of the A.S.A., said that probably the most important matter to come before the board of directors in the last 12 months had been reorganization of the Advisory Committee by including executives from industries not previously represented in the work. "The fact that men like Howard Coonley, Ralph Budd, Floyd Carlisle, Karl Compton, Lammont du Pont, Lincoln Filene, Walter Gifford, Leroy Lincoln, J. H. McGraw, Jr., A. W. Robertson, Alfred Sloan, E. R. Stettinius, and Walter Teagle are willing to serve on such a committee," said Mr. Prentis, "may be considered as some measure of the importance of the work."

Since the date of the last annual meeting, the American Standards Association has approved 64 standards, 45 of which are revisions of work previously approved and 19 are new. The work includes a number of safety codes, specifications for steels for particular purposes, methods of test for petroleum products, standards for machine tools, for flanges and fittings, electrical equipment, for wrought-iron and wrought-steel pipe and tubing, a number of paint specifications, etc. Some 600 organizations, including the A.S.M.E., have taken part in the work during the year through nearly 3000 representatives enrolled on A.S.A. Committees.

Commenting on work in another important field of standardization activity, F. M. Farmer, chairman of the Standards Council, reported that the A.S.A. Committee on Toxic Dusts and Gases has standards in draft form for four toxic substances in wide industrial use,

namely, carbon monoxide, benzene, hydrogen sulphide, and carbon disulphide. When these standards are approved they will make available to industry for the first time authoritative opinion on what concentrations of these gases may be considered injurious to health. These standards when completed will serve as a guide to other A.S.A. committees working on the design and operation of exhaust systems.

New Work Undertaken

Speaking of new work undertaken this year, Mr. Farmer said that plans were being made for the standardization of aircraft engines and fuels on a national and an international scale. While the situation in Europe has brought much of the international work to a standstill, preparedness in our own country has increased the need for American standards that will help to step up production and make replacements easier. "From the point of view of the public," Mr. Farmer said, "this work should make airplane travel safer by tending to unify safety regulations."

Mr. Farmer also spoke about a standard defining varieties of bituminous and subbituminous coals which was completed during the year and which, with the three coal standards previously approved, now provides a complete classification for American coals from anthracite to lignite. This classification, carried out under the technical leadership of the American Society for Testing Materials, has involved the work of some of the leading geologists, chemists, coal experts, and power engineers of the United States and Canada.

1940 A.S.A. Officers

In addition to reports on the work, announcement was made of new officers for 1940. Edmund A. Prentis was reelected president; R. E. Zimmerman, was reelected vice-president; R. P. Anderson, secretary of the division of refining of the American Petroleum Institute, was elected chairman of the Standards Council to succeed F. M. Farmer; and H. S. Osborne, engineer in charge of operating results of the American Telephone and Telegraph Company, was elected vice-chairman of the Standards Council.

American Engineering Council

Presents

The News From Washington and Elsewhere

Joint Committee Studying Future of A.E.C.

ORGANIZATION of the special joint committee formed to consider the future form and scope of the American Engineering Council took place at its first meeting held November 27 in New York City. The group, appointed at the suggestion of the Council's president and executive committee, includes three representatives of each of the three founder societies that are Council's chief supporters—the American Society of Civil Engineers, The American Society of Mechanical Engineers, and the American Institute of Electrical Engineers—plus three men representing the A.E.C. All members were present and, in addition, the Council's president, William McClellan, and Secretary F. M. Feiker.

The meeting opened with a statement by Dr. McClellan outlining the background leading to the call for formation of the committee. He discussed the need for professional unity among engineers and the necessity for having some interprofessional body to advance the public understanding of the profession of engineering, with special reference to the part that engineers should play in solving social and economic questions upon which they are peculiarly qualified to advise. The American Engineering Council, he pointed out, is not a superorganization, but a functional service group for its members that is devoted to public service rather than to the specialized technical and engineering problems of the respective engineering societies. This membership now comprises over fifty national, state, and local technical organizations. In the last five years the number of state and local members has doubled.

Dr. McClellan then reviewed the constant difficulties experienced in financing the work of the A.E.C., in keeping the rank and file of member societies informed as to its accomplishments, and in meeting the many opportunities for service presented to the Council, many of which must of necessity be deferred because of lack of funds. He expressed the hope that the committee would consider these questions carefully from the long-range point of view, and suggested the organization of subcommittees to take up various phases of the whole problem.

A lengthy discussion followed Dr. McClellan's talk, from which there emerged a number of major ideas that may be summed up as follows:

1 Some organization is essential, similar in character to the American Medical Association and the American Bar Association, to work toward the dual objectives of interprofessional relations among engineers and a combined professional approach to public problems.

2 The present American Engineering Council represents one method of providing such a body.

3 There should be closer coordination between the activities of the American Engineering Council in its specialized public-relations field and the various committees of its member organizations set up for similar or coordinate objectives such as, for example, the general advance of professional standards and the economic status of engineers, and interrelations between education and engineering.

4 The engineering profession as a whole has yet to find a means of advising the younger engineers on questions involving their future professional status.

The committee then organized, electing Dr. John C. Parker (A.I.E.E.) chairman and T. F. Barton (A.I.E.E.) secretary. Three subcommittees were authorized to consider questions of membership, scope, and finance, and to be headed, respectively, by Malcolm Pirnie (Am. Soc.C.E.), Harold M. Lewis (Am.Soc.C.E.), and John S. Dodds (A.E.C.). To meet the immediate financial situation it was recommended that each of the three founder societies contribute not less than $8300 to the A.E.C. during the year 1940. The meeting then adjourned, to be reconvened at the call of the chairman.

Program Shaping Up for A.E.C. Annual Assembly

While the full program for the Twentieth Annual Assembly of American Engineering Council, to be held in Washington, January 11–12, 1940, is not yet ready for announcement acceptances already received indicate that the high standard of interest set by previous meetings will be fully equaled, if not exceeded.

One prominent speaker will be John M. Carmody, Administrator of the new Federal Works Agency, who ranks as one of the highest engineers in the federal service and who has charge of a large proportion of the government's public-works program. Another will be A. C. Shire, of the U. S. Housing Authority, who will discuss the highly important subject of government fees for engineering services. Otto S. Beyer, a member of the National Mediation Board, will be a third, dealing with the timely question of adjustment of labor difficulties. Additional speakers will be announced later.

Committee reports to be presented will be of unusual importance, and will include the results of the year-long study of the patent system, sponsored jointly by the A.E.C., the National Association of Manufacturers, and The Conference Board, as well as the first nation-wide symposium dealing with the activities of engineers in the public welfare.

Local Sections

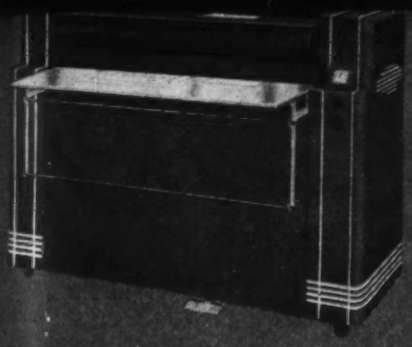
Coming Meetings

Anthracite-Lehigh Valley. January 26. At Easton, Pa. Speaker: H. H. Snelling, vice-president of the A.S.M.E.

Chicago. January 10. 7:30 p.m. in the Theater of Chicago Lighting Institute, 36th floor, Civic Opera Building. Subject: "Fisk Station Topping Unit Operation," by A. E. Grunert, superintendent Generating Stations, Commonwealth Edison Co. Mr. Grunert is the Melville Medalist of 1931.

January 23. 7:30 p.m. at the Civic Opera Building. Sponsored by the management division of the Chicago Section. For the first

(*A.S.M.E. News continued on page 94*)



New Bruning Mercury "75" Printer

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2 Operates at speed of 20 feet per minute, with medium speed blue print paper or BW paper.

3 Current consumption only ⅓ that of carbon arc machines of equal capacity.

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6 No bothersome, time-wasting changing of carbons or globes.

7 Faster, easier, more economical operation with improved printing results.

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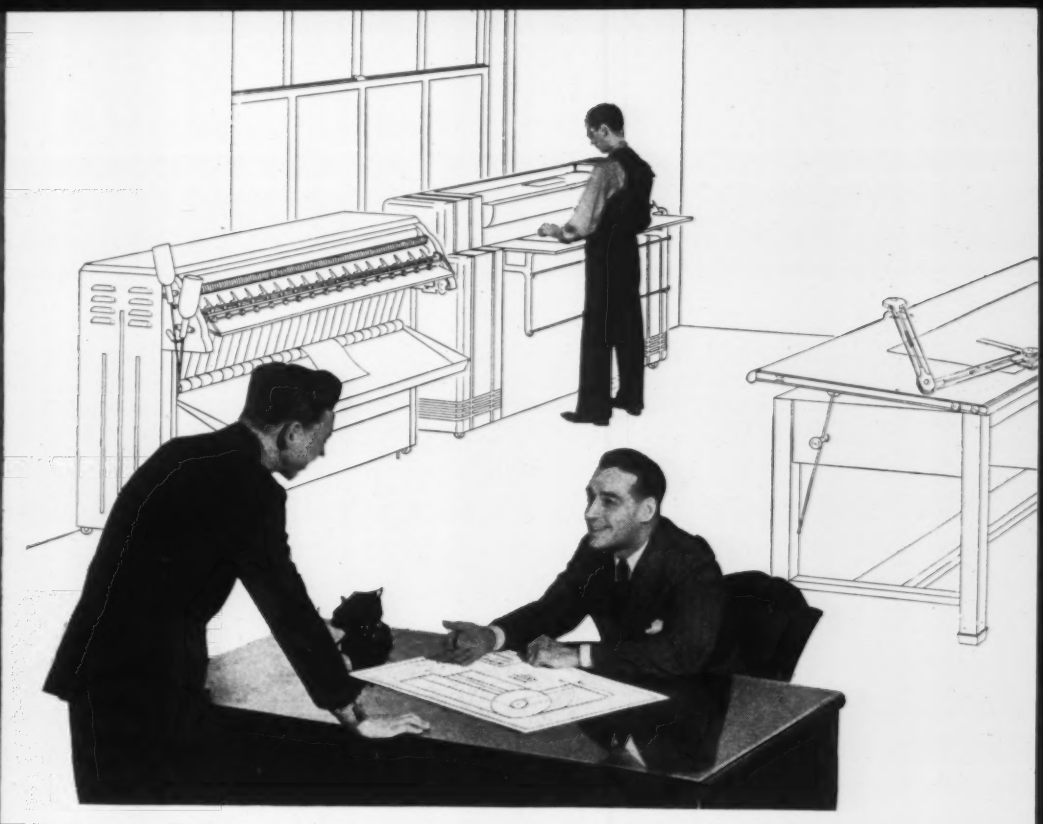

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time a meeting is to be devoted to the discussion of "Insurance Problems and Policy of the Executive." The speaker will be R. K. Hill, superintendent, Springfield Fire and Marine Insurance Company, who is a forceful speaker and who has had many years experience in handling special accounts.

January 30. 7:30 p.m. in the Theater of Chicago Lighting Institute. Subject: "Requirements for Industrial Engineers and Executives," by L. W. Wallace, director of engineering and research, Crane Co., Chicago, F. A. Peck, vice-president of The Trundle Engineering Co., Cleveland, and Dean H. P. Dutton, Armour Institute of Technology, Chicago, Ill.

Metropolitan. January 31. 8:00 p.m., Engineering Societies Building. Subject: "Aims and Responsibilities of Management Today," by Howard Coonley, president of the National Association of Manufacturers for 1939.

New Orleans. January 12. Meeting will start at 9:00 a.m. General Section Meeting, preceding Louisiana Engineering Society Annual Meeting. Paper on civic responsibility of the engineer or some such similar subject.

Men and Positions Available

Engineering Societies Employment Service

MEN AVAILABLE[1]

MECHANICAL ENGINEER, 23, graduate M.E., 1939, single. Now employed as estimator for large Middle West building-materials concern. Looking for opportunity in East, preferably New England. Desires training sales or production engineering. Me-401.

JUNIOR TECHNICAL EXECUTIVE; graduate mechanical engineer with thorough knowledge of machinery production and management. Location, secondary. Now employed. Married. Me-402-207-Chicago.

EXECUTIVE, 41; 8 years in plant management and 10 years as consulting engineer in finance, manufacturing, and marketing problems of diversified industries. M.I.T. graduate, patent attorney, and lawyer. Me-403.

PLANT SUPERINTENDENT, 32, married. Experienced in economical manufacturing of products using sheet metal, structural steel, and castings in their construction. Now employed, available on reasonable notice. Me-404.

MECHANICAL ENGINEER, 27. Desires position with consulting-engineering firm. One year in shipyard piping department; three years' drafting and sales with concern dealing largely in reciprocating power-plant machinery repairs. Me-405.

MECHANICAL ENGINEER, B.S.M.E.; 26; single. One year oil-pipe-line operation; four years clerk in school library; some sales work in hoisting equipment. Interested in ship power-plant installation. Me-406-3812-D-3-San Francisco.

INDUSTRIAL ENGINEER, 28, graduate. One year inspection and designing spring department large steel corporation; four years' experience time and motion study, routing, scheduling, cost work, plant layout, general factory supervision. Me-407-9174-Chicago.

ENGINEER, 47, married, licensed. Seventeen years' experience project engineer, chemical and explosives plants; two years as safety supervisor; four years as estimator oil-refinery construction. Qualified engineering executive or assistant with excellent record. Me-408.

MECHANICAL ENGINEER, 29, married, graduate University of Illinois, 1934. Two years' tool and die making and designing; 3 years metallurgical work; postgraduate courses taken in arc welding and motion study; employed. Me-409.

MECHANICAL ENGINEER, 1939 graduate. Architectural drafting and general machine-shop experience in small shop. Adaptable, industrious, reliable. Citizen, unmarried, age 26. Location second to opportunity. Me-410.

MECHANICAL ENGINEER; 36; graduate Purdue University. Ten years' varied experience including design, time study, stress analysis, cost reduction, experimental testing; mechanically inclined and good draftsman. Desires responsible position. Me-411-8589-Chicago.

MECHANICAL AND ELECTRICAL ENGINEER of mining properties specializing in cleaning processes; 25 years' experience in design, construction, and operation of mechanical and electrical equipment at mining properties. Available now. Me-412.

SALES ENGINEER, experienced selling industrial and railway equipment including Diesel engines, familiar distributor selling, domestic, export, graduate mechanical engineer having broad manufacturing training, offers services for metropolitan New York or East. Me-413.

MECHANICAL ENGINEER, 25, married, Penn State graduate. Design, construction, estimating, maintenance experience in steam processes, industrial power plants, piping, control systems, specialties, pumps, heating, steel-plate work. Now employed. Me-414.

MECHANICAL AND ELECTRICAL ENGINEER. Ten years' experience in development and design of intricate mechanisms, automatic machinery, experience in shop and field. Capable of taking charge of responsible work. Now employed. Me-415.

[1] All men listed hold some form of A.S.M.E. membership.

POSITIONS AVAILABLE

SALES ENGINEER, 30–35, graduate mechanical engineer, to handle small equipment for railroads. Must have sold mechanical apparatus to railroads. Headquarters, New Jersey. Traveling. Y-4975.

SALES ENGINEER, at least 30, graduate mechanical or metallurgical engineer to specialize in the sale of condenser tubes. Will call on public utilities, oil refineries, power plants, and other industrial accounts all over the United States. Experience in sale of power-plant or heat-exchanger equipment to various classes of trade mentioned preferred, but not essential. Must have experience in brass and copper products. Headquarters, Middle West. Y-4980C.

DESIGNER, graduate mechanical engineer to design special apparatus. Work will involve following operations in field and making modifications in design based on observations. Experience in designing bearings, gears, etc., would be advantage. Salary, at least $200 a month. Location, Pennsylvania. Y-5003.

DESIGNER, graduate mechanical engineer with experience in small motion products such as toothbrushes, shavers, etc., powered by fractional and flea-hp motors. Will be responsible for entire design, setting up assembly, and setting of standards of inspection for new product. Salary, at least $2600 a year. Location, East. Y-5009.

CHIEF DRAFTSMAN, preferably one familiar with copper refinery. Should reside in Eastern Central States. Y-5012.

GRADUATE MECHANICAL ENGINEER, about 30, preferably with about five years' experience, including knowledge of drafting, machine and tool design, and manufacturing methods involving small interchangeable precision parts. Must have executive ability, tact, and aggresiveness. Location, New England. Y-5013.

SALES MANAGER, mechanical engineer reasonably well grounded in machine tools and production machinery. If possible, should have knowledge of precision gaging, i.e., type of gaging used in inspection department for classification of parts before final assembly. Should have executive sales experience and capacity. Salary, about $7500 a year. Location, Middle West. Y-5018C.

MECHANICAL ENGINEER familiar with modern steam theory, equipment and design. Experience in power-station operation desirable and with public-utility systems and operations of great value. Duties cover preparation of reports on determination of economic steam conditions for plant, based on load factor, character and cost of fuel, condensing-water facilities, and general characteristics of site; estimates of investment and production costs for utility and industrial steam plants; in general, research and analysis work on large variety of steam-power-plant problems. Must be able to prepare well-arranged and well-phrased reports. Location, New York, N. Y. Y-5035.

GRADUATE MECHANICAL ENGINEER, 25–35, with five to ten years' experience, to supervise design and layout of both semicommercial and full-scale chemical-plant equipment for research and development department of large chemical manufacturing company. Location, New Jersey. Y-5044.

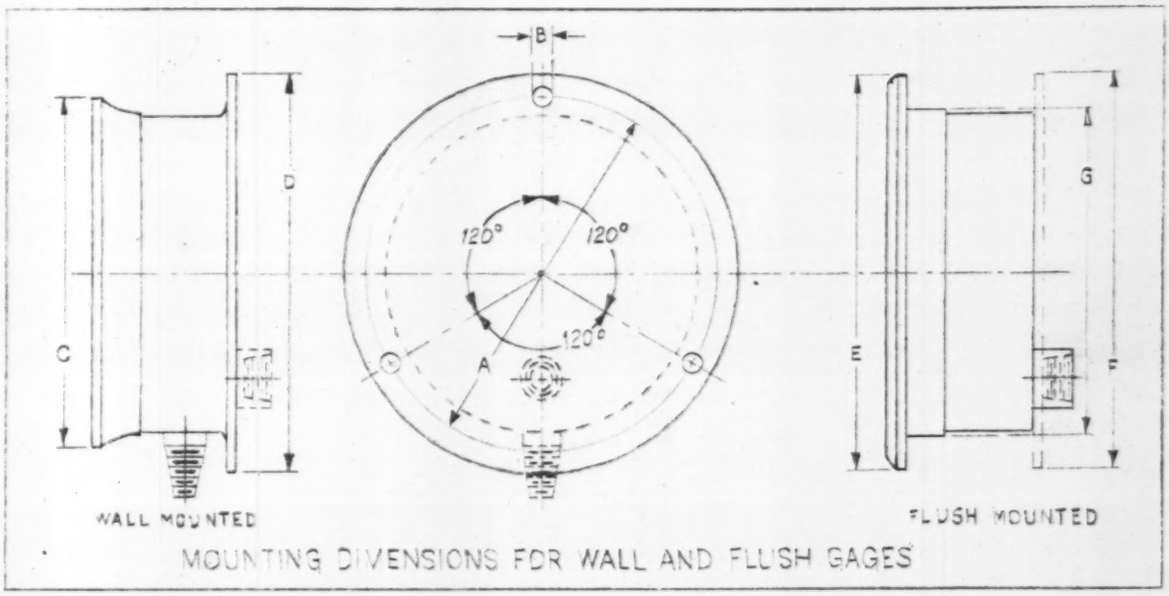
ESTIMATOR trained in estimating in various trades, such as pipe fitting, electrical, machine-shop, and miscellaneous work required in industrial plants of chemical nature. Location, Pennsylvania. Y-5045.

SUPERINTENDENT, not over 45, with at least five years' experience in similar capacity in manufacturing plant. Experience in sheet-metal work very desirable. Must be able to handle large number of men. Salary, $65–$75 a week. Location, Virginia. Y-5047.

(*A.S.M.E. News continued on page 96*)

*TYPHONITE ELDORADO PENCIL PAGE

Sizes and Dimensions of PRESSURE AND VACUUM GAGES



MOUNTING DIMENSIONS FOR WALL AND FLUSH GAGES

General Requirements

1. **MOUNTING HOLES**
   The flanges of all gages shall have three mounting holes, 120 deg. apart, with one hole on the vertical center-line at the top.
2. **LOCATION OF PRESSURE CONNECTIONS**
   Wall-mounted and plain-mounted gages may be either bottom or back connected. Flush-mounted gages shall be back connected.
3. **TYPE OF PRESSURE CONNECTIONS**
   All pressure connections shall be external or internal, American Standard, taper pipe thread.
4. **SIZE OF PRESSURE CONNECTIONS**
   All connections shall be ¼ in. or ½ in. size.
5. **STOP PINS**
   A stop pin at the beginning of the scale is required on all gages, except Grade AA and Pressure-Vacuum Gages.
   Stop pins shall be placed at both ends of the scale of gages to be used for low-pressure heating boilers.
   If stop pins are used on test Grade AA gages, they shall be located below the zero point of the scale.

Gage Sizes and Dimensions

Nominal Size of Gage	Diam. of Bolt Circle A	Size of Bolt Holes B	Outside Diameters of Shell and Ring—Max C, D, E, and F	Outside Diam of Case—Max G
2 ½	3 ⅛	5/32	4 ½	2 ¾
3 ½	4 ¼	5/32	5 ½	4
4 ½	5 ⅜	7/32	6 ½	5
5	5 ⅞	7/32	7 ½	5 ½
6	7	9/32	8 ½	6 ½
8 ½	9 ⅝	9/32	11	9
10	11 ¼	9/32	13	10 ⅝
12	13 ½	9/32	15	12 ¾

All dimensions are given in inches

FREE for hanging in the drafting room. An actual size blue print of this chart reproduced from the original drawing prepared with Typhonite Eldorado Degrees H, 2H, 3H, 4H, 5H, 6H and 7H. Just write to Pencil Sales Department, JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J. for blue print No. 100-J1. Note the quality of the blue print—proof that Typhonite Eldorado pencils are ideal tools for draftsmen.

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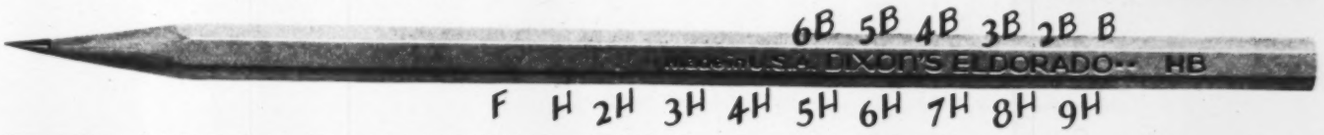
NOTE—*Data on this page taken from the American Standard for Indicating Pressure and Vacuum Gages (B40.1-1939) published by The American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y.*